INDIAN CENTRAL JUTE COMMITTEE

Annual Report of the Jute Agricultural Research Institute, (1950-51)

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ANNUAL REPORT OF THE JUTE AGRICULTURAL RESEARCH INSTITUTE, (1950-1951)

INTRODUCTION

During the year under report jute and substitute fibre crops occupied 27 acres and 3 acres respectively. Of the 27 acres under Jute, 6 acres were for multiplication of seeds of improved strains and 21 acres for experimental crop. On account of shortage of land some experiments were dropped and the plot-sizes of the experimental plots, in some cases, were reduced.

Crops other than jute and substitute fibre were also grown on a profit basis in an area of 18.3 acres during the year under report after harvest of experimental fibre crops. The acreages under other crops were as follows. (*i*) Paddy—9.0 acres, (*ii*) Gram—7.0 acres, (*iii*) Vegetables—2.0 acres and (*iv*) Khesari—0.3 acres. These crops greatly helped in keeping the weeds, suppressed for the successive jute crop.

SEASON

The season on the whole was not favourable for jute crop. Pre-monsoon rains were inadequate and late; land preparations were, therefore, affected. The sowings were late and continuous rains thereafter, in June, July and August interfered very much with the intercultural operations resulting in poor crop growth; as a result some of the experiments had to be abandoned altogether.

The data on rainfall and number of rainy days in the years in 1948-49, 1949-50 and 1950-51 are given below:—

Months	1948-49		1949-50		1950-51	
	No. of rainy days	Rain-fall (Inches)	No. of rainy days.	Rain-fall (Inches)	No. of rainy days	Rain-fall (Inches)
April ...	5	1.99	11	6.67	2	1.72
May ...	12	5.07	12	17.08	9	2.44
June ...	14	7.20	15	11.02	18	10.32
July ...	22	7.60	25	16.59	26	8.92
August ...	23	12.00	19	7.49	23	10.51
September ...	20	8.42	23	11.75	10	1.56
October ...	4	3.03	13	5.68	12	7.13
November ...	8	4.10	—	—	7	7.14
December ...	—	—	—	—	—	—
January ...	2	0.16	—	—	—	—
February ...	1	0.08	2	0.37	—	—
March ...	1	1.64	3	0.58	6	2.92
Total ...	112	51.29	123	78.23	113	52.66

It may be mentioned here that rainfall was better distributed in the year 1948-49 which was more satisfactory year for jute crop than 1949-50 and 1950-51 at Chinsurah. Early sowings in April and May generally give satisfactory crops of jute under Chinsurah conditions. In 1949-50 heavy early rains were received and though the sowings were earlier the crop suffered afterwards due to continuous rains that interfered with the intercultural operations. In 1950-51 the rains were late and not sufficient; sowings were therefore late. The crop also suffered from continuous rains after sowing whereby timely intercultural operations under proper soil moisture conditions could not be given.

It would seem that for jute, the distribution of rainfall is a very important factor in addition to toal precipitation received. Under Chinsurah conditions a rainfall of about 7

inches to 10 inches in April and May distributed over 15 to 25 days is ideal for early sowing. For proper intercultural operations a rainfall of about 15 inches to 20 inches during June and July distributed over to about 30 days seems ideal for growth.

A total rainfall of 45 inches to 55 inches for the whole year seems good enough for jute, provided the soils are retentive. For lighter soils a heavier rainfall will be required.

DEVELOPMENT OF THE JUTE AGRICULTURAL RESEARCH INSTITUTE AT BARRACKPORE

The Government of West Bengal have acquired for the Agricultural Research Institute of the Indian Central Jute Committee a plot of land measuring 94.98 acres at Nilganj near Barrackpore. The land has been taken possession of and arrangement has already been made to bring it under cultivation. Some more area is expected to be acquired in the near future. The Committee has sanctioned a sum of Rs. 8,14,550 (Rupees eight lakhs fourteen thousands five hundred and fifty) for the building of some staff quarters, farm buildings, etc. and also for part of the construction of Institute buildings. Construction of the quarters, etc. will be taken up very soon.

The present temporary conditions with the farm at one place, the Laboratory at another place and the godown also at another place, have not at all been very satisfactory for the working of the Institute. Our work has suffered to some extent due to these adverse working conditions, although the staff did their best in carrying out their respective duties. The setting up of the Institute at Nilganj near Barrackpore on our own land with the farm, Laboratory, godown and staff quarters, all at one place, will be very congenial to the smooth and efficient running of the Institute.

DEVELOPMENT OF A SUITABLE SEED DRILL

It has been established by research work carried out for a number of years at the Jute Agricultural Research Institute that

line growing of jute is more profitable than the usual broadcast method. In line-growing cost of production of the crop is reduced, more uniform crop is obtained, and the yield is increased somewhat.

Line-sowing of jute in considerable acreage is not possible without a suitable seed drill. The necessity of evolving a suitable seed drill for sowing jute seeds (which are very small, light and more or less angular in shape) was realised and several types of drills were examined and tried, but without much success.

At the meeting of the Indian Central Jute Committee held in September, the utility of a suitable seed drill was explained and the Agricultural Research Sub-Committee agreed to offer a prize of Rs. 3000/- to any one who will evolve the best jute seed drill, the cost of which would be about Rs. 50/-. A small Sub-Committee consisting of Dr. J. S. Patel, Mr. John A. Manawwar and Dr. B. C. Kundu was formed to draw up the specifications for such a drill. The specifications drawn up by the members of the Sub-Committee were accepted by the Indian Central Jute Committee.

The prize about the seed drill was announced in papers and a few drills were received within the specified period, but none was found suitable by the judges.

A bullock-drawn seed drill evolved by Mr. Nandi, Assistant Agricultural Engineer, U.P. has been found to be fairly satisfactory, but the cost of each such drill would be much more than Rs. 50/-. It is not quite suitable for the small holdings of our cultivators, but will prove useful for large farms. Another hand-pushed two-row drill on the model of a Japanese paddy drill kindly supplied by Mr. Ramiah, Agricultural Engineer, I.A.R.I., New Delhi, developed in collaboration with Mr. Ohmes, a German Engineer has also shown promise of success. These will now be tried in the jute growing areas of the different States.

I. BREEDING AND GENETICS OF JUTE

1. Collection of Varieties and Types

In all 142 samples of local jute seeds, including 132 samples that were received late in 1949-50 were grown. Of the 142 samples, 80 were *capsularis* and 62, *olitorius*. They were sown by the third week of May. A prolonged period of drought followed sowings and germination was extremely poor except in 13 *olitorius* materials collected from Bihar and Orissa. Re-sowings of all other plots were done a month later. Germination was fairly good in the re-sown plots. Monsoon, however, set in, soon after re-sowing and proper intercultural operations could not be given to the re-sown plots. This resulted in poor growth of the crop. Full performance of the types could not be studied and bulk seeds were carried forward from those plots for study during the next season. Based on performance of the crop, primary selections were made in the 13 *olitorius* selections from Bihar and Orissa.

143 samples of jute seeds (*capsularis and olitorius*) received after the Jute Season from the 1950 crop were preserved for sowing during the next season. This included 7 samples of *capsularis* seeds received from foreign countries, one each from Tokyo and Florida, 2 from Brazil and 3 from China.

Wild species of Corchorus.—15 samples of seeds of wild species of *Corchorus*, 13 collected from Bombay and 2 received from Saurashtra were grown along with the selections of wild materials already in our collection. There are at present in our collection in all 8 species of *Corchorus* including *Corchorus siliquosus* and a wild form of *Corchorus capsularis*, already reported.

Three distinct types, *viz.* (*i*) Full green, (*ii*) Green-light-red and (*iii*) Light red, isolated from *Corchorus capsularis* (wild) received from Bombay, were grown. The progenies bred true to their parents. The Full green type behaved like the normal cultivated types of *Corchorus capsularis* with a mean height of 6 ft. 6 inches and a base diameter of 1.8 cm. The other two types, however, *viz.* Green-light-red and

Light-red, maintained their dwraf, bushy habit. All the three types were rather late as regards maturity. Selections have been made from all these types for further studies in the next season.

2. BREEDING OF JUTE.

During the year 10 breeding trials were planned and sown with promising cultures brought forward from the previous year's crop. Eight of these trials were *capsularis* and 2 *olitorius*. Six of the *capsularis* trials which suffered from prolonged drought immediately after sowing, had to be rejected for extremely poor germination. Selections were, however, carried forward from these trials for trial during the next season.

65 primary and 3330 secondary selections were made in the type plots and the breeding trials respectively. Pigmentation, height, base diameter, branching habit, date of first flowering, etc. of individual selections were recorded. Seeds of all these selections were collected separately, weighed and preserved for further study.

First year test of selections.—(*i*) *Capsularis*—38 primary selections from the last year's district materials were sown in two first year trials. Germination was very poor in these trials due to drought that followed sowing. The trials were not harvested for fibre. 114 selections were, however, made from the different cultures with a view to test them in first year trials during next season. These will be treated as primary selections.

(*ii*) *Olitorius*—36 primary selections carried forward from last year were sown in a first year *olitorius* trial. This trial also suffered from the effect of drought. The condition of the crop, however, improved slightly after an irrigation. The stand in four blocks, out of six was fair. 288 selections were made from all the cultures for further study. The yield data showed that one culture, O49-12090, a selection from Barsoi, Bihar, proved significantly superior to the control. The standard error of the experiment was very high and as such the

reliability of the result is doubtful. It is, therefore, proposed to repeat the trial next year.

Second year test of selections.—(*i*) *Capsularis*—3 second year trials were planned and sown with 26 families of 6 Progenies each. Two of the trials successfully withstood the effects of the drought but the third failed due to extremely poor germination. 1908 secondary selections were made from the three trials for further study. The yield data of the two successful trials were analysed. Only 2 families, *viz.* C48-795 and C48-850, which were statistically as good as the control but yielded slightly higher, were carried forward for further study.

(*ii*) 8 families of *olitorius* materials of 5 progenies each, carried forward from the *olitorius* first year trials of 1949, were tested in a compact family block layout. The cultures were studied and 720 secondary selections were made from all the cultures. The yield data were analysed, but none of the families proved significantly superior to the control.

Third year test of selections.—5 *capsularis* families with 6 progenies each, carried forward from the previous year, were sown in a third year trial on 8th June 1950. This was very late in the season. Sowing was followed by monsoon that interfered with intercultural operations. The plots became heavily weedy. This resulted in extremely poor growth of the crop. Besides, there was a heavy incidence of stem-rot in all the plots. The trial was abandoned after retaining 90 selections for trials again during the coming season.

There was no *olitorius* material at the third year stage.

Test of Selections in Multiple Crossing materials.—14 families of multiple crossing materials consisting of 70 progenies were sown in two compact family block trials. Here again germination was very poor due to prolonged drought. 252 secondary selections were made from different cultures to repeat the trial in the next season.

Besides the materials mentioned above, 25 selections not included in trial in 1949 were multiplied. 42 selections were made in these materials for trial in the following season.

Varietal Trials.—Capsularis—3 varietal trials were planned with the promising *capsularis* strains evolved by the Jute Agricultural Research Institute. The first trial that included the more important materials was sown on the 13th April 1950 along with three other promising strains with Fanduk and D154 as early and late controls. Performance of the crop in this trial, which received timely interculture and also an irrigation, was quite good. Germination in the second trial which was sown on the 15th April 1950 was, however, not very satisfactory, while the third trial sown on the 25th May 1950 failed due to incessant rain that followed sowing. The first trial was harvested and the quality of the fibres was tested by the Technological Research Laboratories from samples sent to them. The yield data and the quality ratio figures are given below :—

TABLE I

Date of sowing—13. 4. 50. Harvested between 21. 8. 50. and 11. 9. 50 at the small pod stage.

Layout—Randomized blocks in 6 replications. Effective plot size-1/83rd acre.

Variety	Yield per acre in Mds.	Percent on control	Date of first flower	Quality ratio
J. R. 48—1 ...	29·59	106·59	6-8-50	82 ± 0·9
C39-212 ...	29·50	106·26	30-7-50	110 ± 2·0
Orissa 6j ...	28·58	102·95	7-8-50	113 ± 1·3
C41-13 ...	27·82	100·22	29-7-50	85 ± 0·5
D154 ...	27·76	100·00	13-8-50	93 ± 1·0
Jap Rd. ...	23·86	85·95	19-8-50	126 ± 1·2
Fanduk ...	22·00	79·25	24-6-50	122 ± 1·5
C42-Kj-321 ...	19·24	69·31	26-7-50	106 ± 1·1
P — ...	0·01			
Critical difference	3·51 Mds.			
Standard error %	3·51			

It may be seen from the above that the varieties J. R. 48-1 and C39-212 have given about 6% higher yield than the control D154, though they are statistically as good. In res-

pect of maturity these two varieties are one week and two weeks earlier than the control. Regarding quality ratio, it may be seen that Jap Rd. gave a quality ratio of 126 as compared to 93 of D154. Quality of Fanduk fibre followed closely with a ratio of 122 whereas quality ratios of Orissa 6j, C39-212 and C42-Kj-321 were in the order of 113,110 and 106. C41-13 and J.R. 48-1 proved inferior to D154 in fibre quality. Considering all the aspects, it may be said that C39-212 is a desirable *capsularis* strain as it combines in it earliness, high yield and better quality of fibre.

Olitorius—A varietal trial was carried out with three improved *olitorius* strains evolved by the Jute Agricultural Research Institute along with R26 and C.G. The trial was sown on the 13th May 1950. Germination was good in all the plots. It showed promise of a good crop at the early stage, but incessant rain caused waterlogging in the field and the crop suffered from adverse growth conditions. The trial was harvested on the 21st September 1950. Quality of the fibre was tested by the Technological Research Laboratories from samples sent to them. The yield data and the quality ratios are given below:—

TABLE II

Date of sowing—13.5.50. Harvested between 21.9.50 and 22.9.50 at small pod stage.

Layout—5 × 5 Latin square. Effective plot size—1/67th acre.

Variety	Yield per acre in maunds	Percent on control	Date of first flowering	Quality Ratio
O40—632 ...	19·42	132·29	31. 8. 50.	88 ± 0·8
O40—753 ...	18·67	127·18	1. 9. 50.	104 ± 1·4
O39—620 ...	16·29	110·97	28. 8. 50.	133 ± 1·2
C. G. ...	14·68	100·00	22. 8. 50.	109 ± 1·0
R 26 ...	12·93	88·08	4. 9. 50.	89 ± 0·8
P ...	0·01			
Critical difference	2·26 mds.			
Standard error %	3·49			

It may be seen from the above table that two of the three improved strains, *viz.* O40-632 and O40-753 proved significantly superior in yield to the control, C.G., at 1% level, yielding approximately 32 and 27 per cent respectively higher than the control. O39-620 proved statistically as good as control and yielded 11% higher. O39-620 gave an excellent quality ratio of 133 as against 109 of C.G. O40-753 with a ratio of 104 followed closely whereas R26 and O40-632 proved inferior to the control in the quality of fibre.

Polyploidy and interspecific hybridization in jute :— *1948 Treatment*—75 capsules from 15 *capsularis* plants showing the morphological characteristics of polyploid plants were sown. Only 11 plants were obtained and all the progenies maintained the morphological characteristics of the parents. 8 plants out of these produced seed which was collected both capsule-wise, at the rate of 5 capsules from each plant, and bulk seed of the rest of the capsules.

Olitorius seeds collected from the 1949 crop were also sown. The progenies did not show morphological features characteristic of polyploids. The materials were, therefore, rejected.

1950 Treatment.—As the colchicine treatment of 1948 failed to produce true-breeding polyploids in *olitorius*, it was felt necessary to repeat the treatment. Seeds of *capsularis* and *olitorius* were soaked in colchicine solutions 0.0125, 0.025, 0.05, 0.10 and 0.15 per cent for five different periods—3, 6, 12, 18 and 24 hours, thus, giving 25 treatments each of *capsularis* and *olitorius*. In each treatment 50 seeds of *capsularis* and 50 of *olitorius* were used giving a total of 1250 seeds for each species. Germination in 3 and 6 hours treatments in both the species was fairly good. Germination was lower with longer hours of treatment and higher concentrations of the alkaloid.

27 plants of *capsularis* and 21 of *olitorius* were found to exhibit polyploid appearance and seeds were collected from them pod-wise. 161 capsules from *capsularis* and 248 from *olitorius* plants have been collected. Seed counts have been

taken of all these and it is proposed to sow all the capsules separately next year.

One *olitorius* plant—plant No. 5059 from treatment 24 hours and 0.025% alkaloid was found to be polyploid but as the plant did not set any seeds, no seeds could be obtained.

Materials from all the plants have been fixed for cytological studies.

Interspecific hybridization using polyploid parents will be tried soon after pure-breeding races are established.

Vegetative rapprochement as a means of overcoming interspecific cross incompatibility in jute.—Seeds of interspecific grafts made in 1949 were sown. Growth of the crop was poor due to incessant rain. Second generation grafts could not be made. Seeds were, however, collected from them for continuing the studies next season. 20 fresh interspecific grafts were made during the year.

3. INHERITANCE OF CHARACTERS.

Genetic Strains—All the 45 strains reported last year were grown along with 10 cultures brought forward from the purification series for study and confirmation. Such characters, as pigmentation patterns, branching habit, leaf shape and size including the shape of the leaf-margin, taste of the leaf—whether bitter or non-bitter, corolla colour and shape, anther colour, length of the style, pod size and shape, seed coat colour, etc. were noted for individual progenies with a view to ascertain whether the materials were segregating for any of these characters. 51 cultures were found to be breeding true to the parental characters. 255 selections were carried forward from these cultures for further study.

Of the 98 selections made in 1949, in the different plots for study, 82 were grown in a purification series. Performance of the progenies of the different selections was studied in respect of the characters noted above. 135 selections were made in the different cultures for study and confirmation during the next season. Thus a total of 390 selections from various sources

were carried forward for further study and confirmation. This work will continue and a comprehensive series of established genetic strains will be built up and fresh strains will be added to the collection as new characters are fixed.

Isolation of genotypes.—Full green non-branching segregates from multiple crossing materials segregating into grades (1, 0), (3, 0) and (4, 0) were crossed to a grade 4 type, Kamardani, in 1949 for isolation of full-green genotypes. The crosses were grown and studied. Crosses between the grade 4 and grade 0 from (1, 0) segregation gave grade 1 plants as expected. Similarly, crosses of grade 4 with grade 0 plants from (3, 0) and (4, 0) segregations gave grade 3 and 4 plants respectively according to expectation. Thus, the behaviour of 3 full-green non-branching genotypes in respect of the reducer gene and the multiple allelomorphic series affecting the distribution as well as the intensity of the pigment is confirmed. Materials were carried forward for inclusion in the genetic strains.

A large number of test crosses were made during the year for isolation of genotypes both in Indian and foreign types of jute. Crosses and parents were carried forward for study during the following season.

Anthocyanin pigmentation—Crosses between the deep-red and all the other types under the three pigmented groups were grown along with their parents. The F_1s were studied and back crosses between the F_1s and the parents concerned were obtained.

The F_1s of crosses between the deep-red and the full-green (2) type, *i.e.* fullgreen without the reducer gene, were all deep red like the red parent.

F_1s of crosses between the deep-red and the types under the green-pigmented group, showed reduction of the pigment as compared to the deep-red parent, but the intensity of pigmentation was higher than the corresponding green-pigmented parents.

Crosses between the deep-red and the members of the red group, showed a little dilution of the 'deep-red' but here again the F_1s were more red than the corresponding red parents.

Back crosses and F_1s were carried forward for further study.

To study the mode of inheritance of anthocyanin pigmentation in foreign types and their behaviour when crossed with Indian types, an elaborate crossing programme, involving a large number of crosses in addition to those already made, was undertaken. 110 fresh crosses made during the year and F_1s of 1949 crosses were carried forward.

Extra axillary branching habit.—All the crosses made last year between the Indian branching and foreign non-branching types were grown along with their parents during the year. The F_1s were all branched like the Indian parental type and all the branches were axillary. Back crosses of the F_1s with both the parents were made. F_1s and back crosses were carried forward for further studies.

Repand (wavy) leaf type.—Crosses made in 1949 to study the inheritance of this character were grown along with their parents. The shape of the margin of the leaves of the F_1s was found to be intermediate between those of the parental types.

The F_1s were back-crossed to both the parents. Seeds of F_1s and back crosses were carried forward for further study.

Leaf variant.—Crosses between the normal and the leaf variant using the latter as the male parent were grown and the F_1s were studied. The leaf character of the F_1s was like that of the normal parent, all the F_1s were fertile, they did not show any sign of sterility exhibited by the variant. The F_1 was back crossed successfully to both the parents. F_1s and back crosses were carried forward for further studies.

6 selections brought forward from the normal segregates of the culture C48-8565 were grown. 4 of the selections bred true to the normal parent while the remaining 2 segregated giving

normal and variant plants. Counts of the normal and variant segregates were recorded. 18 normal selections were carried forward for further study.

Serrated petal.—6 F_2 families from the crosses between normal and serrated petal *olitorius* types were grown and 4 families consisting of a population of more than 4000 plants were studied and classified. The petal character of the F_2s showed all degrees of serration from fully normal to fully clawed. Materials were carried forward for study at the F_3 stage.

Chlorosis.—Plants showing chlorosis are more frequently observed in *capsularis* than in olitorius. It, therefore, seems that there is a certain degree of resistance to chlorosis in *olitorius.* In *capsularis* again, all varieties do not seem to be equally susceptible to chlorosis. To study the nature of chlorosis in jute, 38 *capsularis* and 4 *olitorius* chlorotic plants were selected. The patterns of chlorosis as exhibited on the leaves were described and classified. 35 crosses were attempted between chlorotic plants and also between chlorotic and normal healthy plants with 12 successes. Crosses and selections of chlorotic plants were carried forward for further study.

4. Subvention Trials.

Seeds for 70 subvention trials, 30 in West Bengal, 14 in Assam, 10 in Orissa and 16 in Bihar, with their sowing plans, necessary instructions for conduction of the trials and final report forms were sent to the officers concerned in proper time. 21 trials were reported to have failed for various reasons, such as, adverse weather conditions, floods, earthquake etc. and 2 trials were rejected for layout mistakes and for poor crop growth. Of the remaining 47 trials sown, final reports on 31 trials only have so far been received. Final reports on the rest 16 trials were awaited which includes 3 trials in Assam and 13 in Bihar.

Technological tests of the samples of fibre sent from these trials are in progress and reports on the results of quality tests are also awaited.

A consolidated report on the performance of the strains as regards yield and quality will be submitted after the results of 1951 trials are received.

II. ANATOMICAL STUDIES

Anatomy of axillary buds in jute.—In the normal branching types, an axillary bud is found at every axil of the leaf. Its size and development may vary from a slight protuberance to a fully developed branch. The non-branching types of *Corchorus capsularis* are conspicuous by the absence of their axillary buds. The developmental anatomy of the axillary buds in the branching and in some non-branching types of *Corchorus capsularis* was studied. Tentative conclusions are given below.

The apical meristem, as it grows, leaves behind a meristematic region, *shell zone*, in the axils of the young primordia. Such a detached meristem can be clearly seen as the meristematic cells, below the apical meristem, become vacuolated. These meristematic cells by further divisions give rise to the axillary buds. But in the non-branching types, *viz.* Halmahera, Jap. Rd. and Grade 3, the detached meristem gets vacuolated in its early stages and loses its activity. Thus, in the older leaves, no trace of axillary bud, or dormant-shell zone is visible. Here and there a poorly developed axillary bud can be seen. They are less differentiated and smaller than the normal buds in the same position. From the complete absence of axillary buds in normal healthy plants during vegetative growth it may be said that such axillary buds do not survive long.

Structure and quality of fibre.—Some work on the structure of the fibre in relation to its quality with tested samples of fibre from Technological Research Laboratories has been reported previously. Similar study of fibres from living plants have been

taken up and the data obtained so far are given below:—

	Number of ultimate fibres per fibre strand		Quality Ratio
	Bottom	Middle	—
1. Corchorus capsularis (D-154)	15·31	12·67	79
2. Corchorus olitorius (C. G)...	22·37	17·29	88
3. Hibiscus sabdariffa var altissima	20·16	19·51	56
4. Hibiscus cannabinus ...	25·38	20·06	80

The above data shows that the quality ratio increases with the increase in the number of ultimate fibres within the two genera, *viz. Corchorus* and *Hibiscus*. Further work is in progress.

The effect of maturity on the length, breadth and lumen of ultimate cells—The spinning quality of textile fibres is reported in some case, as in wool and flax, to be dependent on the cross-sectional shape along with the characters. To study whether such a relation exists in jute, the breadth, lumen and length of the ultimate fibre cells were studied in six stages of maturity, from prebud to dry capsule stages in Fanduk which is reputed for its fibre quality. Tentative conclusions are as follows.

None of the factors, the breadth, the lumen, the thickness of the wall or the length singly can be taken as a guide to the quality of the fibre. Greater and more significant variation is found in different regions of the same stem than the variation that occurs through the different stages of maturity. The bottom region appears to be the more suitable region than the middle for study because it is less influenced by developmental factors.

On following the breadth and lumen at different stages of maturity in the bottom region it was found that the breadth and the lumen of the ultimate cells attained their maximum dimensions at the bud stage. The attainment of maximum breadth and lumen at the bud stage appeared to be an index of physiological activity during the vegetative growth. It is borne out by technological tests that harvest at this stage will always yield good quality fibres. At the later stages the fibre cells shrink along their longer axis.

Routine identification.—In addition to the normal research work, this Section remained engaged in the examination of samples of various types of fibres. During the period under report a good number of samples were received for identification and for opinion regarding their suitability as a substitute for jute. The required information were furnished after proper examination of the fibres.

III. CYTOGENETICS OF JUTE

An important field of work in this Institute concerns the breeding of high yielding types which combine superior qualities of fibre. It is well known that both as regards average yield and quality of fibre, *Corchorus olitorius* is superior to *Corchorus capsularis*. The former species grows only on high lands while the later thrives on both high and low-lying areas. While it may be difficult to predict the qualities that are likely to emerge in a cross between the two species it is pretty certain that if a cross can successfully be made, we would be breaking new ground, detect undiscovered linkages, and the progeny is bound to yield types which are superior to either parent. Efforts to make a cross have so far failed on account of a strong incompatibility barrier between the two. A proper assessment of the basis of this strong incompatibility is a Cyto-genetical problem of magnitude and among the items of work done in the year under review, a beginning was made in this direction. The karyotypes of the two species with particular reference to the morphology of the individual chromosomes have been studied.

It has been stated above that the pollen grains of the two species show very little sterility. Their general behaviour on artificial media has been studied and the fact has emerged that there is a significant difference in the maximum lengths attained by tubes of the two species under identical experimental conditions. The mean distance separating the stigmatic surface from the ovaries is being compared with the maximum length attained by the pollen tubes. These studies are yielding very interesting results.

Considering the high degree of viability of the pollen grains and fertilisation of a large number of ovules after self-pollination, it would appear that the seat of the incompatibility is the stylar tissue where genetic sterility factors inhibit the growth of foreign pollen. Sterility factors of this kind are well known and have been demonstrated in several cases notably in *Nicotiana*.

Yasuda's method of transplanting pollinated stigmatic tissue is being tried. A new technique for overcoming stylar sterility is being tried out but this is still in an experimental stage. Straight pollination between the two species has proved ineffective.

A comprehensive chromosome survey of the indigenous and exotic species of *Corchorus* is on hand and the object of this project is to establish a basis for intervarietal and interspecific breeding programme. One of the wild species, *Corchorus siliquosus* was found to have fourteen haploid chromosomes.

The effect of carcinogens on seeds and germinating seedlings of the *Corchorus capsularis* and *Corchorus olitorius* is a part of work done in the year. The seeds have been treated with colchicine of strengths up to 0.25% while for stem-tip treatment higher concentrations have been used.

Olitorius plants which were treated with colchicine in 1950 continue to show characteristic morphological changes but very few of these have set seed and the pollen grains showed a high

percentage of sterility. Preliminary examination of the pollen mother cells indicates a definite increase in number but these have to be confirmed from this year's material.

The Cytogeneticist, Dr. K. V. Srinath, took over charge of this Section in March, 1951. The following programme of work has been fixed for the year 1951-52.

(*i*) Chromosome survey of the Indian and exotic species of *Corchorus* with particular reference to variations in morphology of the karyotypes. The object of this survey is to establish a basis for inter-varietal and inter-specific crosses.

(*ii*) Cytological analysis of inter-varietal crosses.

(*iii*) A study of the factors involved in the stray incompatibility between *Corchorus capsularis* and *Corchorus olitorius* in crosses.

(*iv*) Induction of polyploidy by colchicine and other carcinogens and a study of the influence of polyploidy on the gross development of the plant and quality of the fibre.

IV. PHYSIOLOGICAL INVESTIGATIONS

During the period under report much time was taken up in fitting up a laboratory suitable for physiological research. The Junior Physiological Assistant joined in September, 1950, late in the Jute season and the Senior Assistant has not so far been appointed. Due to lack of personnel the progress of work was hampered; a large number of field samples collected during the crop year (1950-51) still remain to be examined.

1. Investigations on the Physiology of Jute Seeds

(A) *Natural viability percentage of Jute Seeds*—Pods from *capsularis* and *olitorius* were collected during the harvesting season. 10 pods were taken from each species and the number of dry seeds formed in each capsule was counted and tested for germination separately in Petridishes, under a constant temperature of 33°C. in an incubator. The results showed that on average the viability percentage of seeds per pod in D 154 was 71.3% and in Chinsurah Green 75.0%, while there is a considerable difference in the average number of seeds per pod

between the two species, being 36·6 in *capsularis* (D 154) and 127·0 in *olitorius* (C.G.), the percentage of non-viable seeds in the two was nearly the same. Further work will be continued.

(B) *Effect of storage on viability of Jute Seeds*—Two years (1948-49) and one year (1949-50) old seeds of different varieties of *capsularies* and *olitorius* were tested for their viability. The rate of germination and the rate of radicle growth under 31°C were recorded.

Preliminary results obtained indicate that rate of percentage of germination and the rate of growth of the radicle vary in different varieties. Storage noticeably decreases the percentage of germination as also the rate of growth of the radicle. Under similar conditions of temperature and moisture, seeds of olitorius show a slower rate of growth of the radicle.

The comparative percentage of germination and the rate of radicle growth in different varieties have been given in Table III.

TABLE III

Varieties	Percentage of germination				Rate of radicle growth			
	1948-49		1949-50		1948-49		1949-50	
Capsularis	24 hrs	48 hrs	24 hrs	48 hrs	24 hrs	48 hrs	24 hrs	48 hrs
					mm	mm	mm	mm
D 154 ...	87·2	94	86	94	8·32	48·62	12·64	54·16
Fanduk ...	81·6	86	87	87	7·49	47·8	13·86	53·44
C-42-Kj 320 ...	81·2	88·4	85	88	10·5	45·7	12·58	52·43
C-41-13 ...	76	83	89	90	9·7	46·1	11·08	52·1
C-39-212 ...	31·6	41·2	84	91	6·32	37·9	9·82	51·58
C-42-Kj-321 ...	81·2	88·4	83	94	7·5	49·4	13·68	53·78
Olitorius					mm	mm	mm	mm
C. G. ...	50	80	70	98	3·56	20·78	5 87	24·94
0-39-620 ...	60	70	80	100	3·45	30·75	4·33	33·70
0-40-632 ...	45	72	85	98	1·3	13·78	1·31	14·68
0-40-753 ...	43	71	80	92	2·7	17·57	2·11	18·13
R - 26 ...	42	75	82	98	1·0	10·7	1·49	13·06

(C) *Dormancy in jute seeds* : —In order to determine if there is any dormant period or after-ripening stage, freshly harvested seeds from different pods of different species and varieties were tested for germination under different temperatures—(*a*) Room temperatures at 22-24°C, (*b*) Incubator at 31°C and (*c*) Refrigerator at 10.3°C.

The results indicated that there was a difference in the germination percentage between seeds of *capsularis* (D 154) and *olitorius* (C.G.). None of the seeds germinated at 10.3°C, while at 22-24°C there has been practically no germination in *olitorius*, but in *capsularis* seeds germination was 51.4% and 76.1% in the two lots of seeds used. Even at 31°C germination was poorer in *olitorius* seeds being only 33.8% and 27.0% in the two lots of seeds used, at that temperature germination percentage was much higher in *capsularis*. These results appear to indicate (*i*) difference in the nature of *capsularis* and *olitorius* seeds and (*ii*) the need for a certain resting period. Further investigations with seeds collected at different stages of maturity will be continued next year.

(D) *Salt tolerance in Jute Seeds at the time of germination.*— This part of the work is exploratory and the object is to estimate the salt (Nacl) tolerance in seeds of different varieties, at the time of germination. Concentrations of 0.25, 0.5, 0.75, 1.0 and 2% were employed along with controls in water. Seeds of both *olitorius* and *capsularis* could not tolerate a concentration higher than 1.0% and even at this strength there was a perceptible delay in germination. This delaying effect was more marked in the case of older seeds (1948-49) than in those of the year 1949-50. An appreciable difference in salt tolerance was noticed in seeds of the different varieties studied but seeds of *capsularis* were more tolerant, as was obvious by their germination rates, than those of *olitorius*, under similar conditions. In *olitorius* there was a delay in germination both in old and new seeds. (*Vide Table IV*)

TABLE IV

Effect of 1% Nacl on the germination of seeds in different varieties.

Varieties	1948-49				1949-50				Control (in water).					
									1948-49			1949-50		
Capsularis	24 hrs	48 hrs.	72 hrs	120 hrs	24 hrs	48 hrs	72 hrs	120 hrs	24 hrs	48 hrs	72 hrs	24 hrs	48 hrs	72 hrs
Fanduk ...	Nil	80·9%	86·2%	96·7%	49·7%	88·5%	88·8%	96·1%	81·6%	86%	97%	86%	87%	94%
D 154 ...	Nil	50·6	82·3	96·5	20·9	85·2	92·4	95·1	87·2	94	100%	86	94	98%
C-41-13 ...	Nil	64·4	90·0	94·7	20·2	93·6	97·9	97·9	76	83	93%	89	90	98%
C-39-212 ...	Nil	40·4	77·7	94·0	17·6	84·3	96·1	96·4	31·6	41·2	80%	84	91	93%
C-42-Kj-320	Nil	73·9	93·9	96·6	30·3	93·3	99·8	99·8	81·2	88·4	97%	85	88	100%
C-42-Kj-321	Nil	75·7	76·1	94·5	24·6	94·6	94·7	96·2	81·2	88·4	98%	83	94	100%
Olitorius														
C. G. ...	Nil	11·0%	39·6%	54·5%	Nil	63·2%	92·6%	92·6%	50·0%	80%	88%	70%	98%	98%
O-40-753 ...	Nil	2·0	2·0	22·0	Nil	73·8	86·9	90·5	43	71	81%	80	92	92%
R-26 ...	Nil	33·0	39 6	56·6	Nil	60·4	91·8	91·8	42	75	75%	82	98	98%
O-39-620 ...	Nil	1·9	1·9	6·8	Nil	62·6	89·6	96·3	60	70	70%	80	100	100%
O-40-632 ...	Nil	80·0	84·6	92·1	Nil	74·1	92·6	96·6	45	82	82%	85	98	98%

2. Root System in Jute Species.

Data on the rooting habits of jute species are very meagre. The two major species, *C. capsularis* and *C. olitorius* are capable of growing under different conditions of soil and moisture. A study of the rooting habits under varying soil conditions is certain to have an important bearing on extension programmes. The work was planned as follows:—(1) Growth and distribution of roots in different kinds of soils, (2) growth and distribution of roots at different stages of vegetative development, (3) root growth in relation to methods of sowing (Broadcast and Line sowing), and (4) effect of manurial treatments on root growth.

The work was confined to a study of root systems in situ in clay soils at the Chinsurah farm. The roots were washed in situ with the aid of water jets, and the side branches were traced as far as possible. In the clay soils of Chinsurah farm, the lengths of the tap root ranged from 2.0″ to 4.8″ in *capsularis* while in *olitorius* it ranged from 3.0″ to 7.0″. In many plants the tap roots were found forked after the first 2-3 inches. The secondary roots in *olitorius* were more elongated and penetrated to greater depths than in *capsularis*. In the latter species, the root branches were more superficial and bushy in nature than in *olitorius*. In *olitorius* the maximum length of secondary root branches ranged around 3 ft. while in *capsularis* it was not more than 1 ft. and eight inches.

In lighter soils the length of the tap roots was greater than in plants growing in the heavy soil of Chinsurah and they did not show any forking. The maximum length of the tap root in *olitorius* was 15.4″ and in *capsularis*, 14.0″.

3. Physiology of growth in different species and varieties of jute with reference to moisture content, fibre growth and wood formation during the life-cycle of the plant.

It has been demonstrated by previous workers that yield of fibre in jute is proportional to the height of the plant and its

basal diameter. But detailed information on the rate of growth of fibre at different stages of the plant, its relation with the formation of wood are still lacking. Knowledge on the variations in growth of these structures, in co-ordination with the total growth of the plant at different phases in its life-history, is essential to understand the nature of the growth of the fibre elements in different commercial types and to enumerate their correct values. With this aim in view the above studies were taken up.

The following *olitorius* and *capsularis* varieties were taken :—

Capsularis	*Olitorius*
(*a*) D 154	(*a*) Chinsurah Green
(*b*) Fanduk	(*b*) R 26
(*c*) C 41-13	(*c*) O 40-632
(*d*) C 39-212	(*d*) O 39-620
(*e*) C 42-Kj-320	(*e*) O 40-753

The above 10 varieties were sown broadcast in replicated plots of 7′ × 13′ size in four replications. Ten plants were selected at random in each replicated plot and marked for periodical growth rate in height, basal diameter, leaves output, date of bud formation, and flowering, and pod formation. These data were collected at about 7 days interval in the field. In addition to the above, actual growth rate in the steam was measured in terms of dry weight for which the following procedure was adopted.

3 plants from each plot were cut at random at the ground level. They were brought immediately to the laboratory and after removing the leaves, each stem was divided into small segments of 6″ each beginning from the base to the apex. The samplings were made at interval of about 7 days, and at each sampling 12 plants from each variety were taken. The sampling was made at 51, 59, 65, 72, 79, 86, 93, 100, 110, 121 and 137 days of growth from the time of sowing. The green weight of the segments of different regions of the stem were determined.

Then they were dried in an electric oven running at 60-80°C. The dry weight gave the actual rate of growth in the different regions of the stem at different ages of the plant. The corresponding moisture content in the stem was thus calculated. In order to find out the formation of wood and of bark (fibre including the soft tissues of the secondary phloem and cortex), the dried segments were moistened over night with water and the bark was then peeled off. They were again dried and weighed separately.

From the above operations the following results were obtained :—

(*a*) Variations in increasing height of the plant.

(*b*) Moisture content in the different regions of the growing stem at different ages of the plants.

(*c*) Dry weight of the different regions of growing stem at different ages of the plant.

(*d*) Dry weight of the wood at different regions of the growing stem and at different ages of the plant.

(*e*) Dry weight of the bark in different regions at different ages of the plant.

From the above category of results it was possible to calculate (*i*) the relation of moisture content per unit of dry matter produced, (*ii*) the rate of total growth in terms of dry matter, (*iii*) the comparative rate of formaton of wood in relation to the growth of the bark, (*iv*) the ratio of growth of bark to that of wood at different periods of growth, and at different heights of the plant.

The results obtained in all the ten varieties have not yet been worked out for proper representation here. Certain important results in case of *capsularis* (D 154) and *olitorius* (C.G.) representing two important cultivated species are given here.

The samples were taken weekly but the results have been discussed at different stages, corresponding to vegetative, bud, flower and pod stage to bring out the significant results.

(*i*) *Variations in growth in height.*—

It was found that in the early stage from the time of sowing, both D 154 and C.G. showed almost the same rate of growth in height which later on became more variable in different species. C. G. showed a higher percentage increase in growth than that of D 154. This difference in height was maintained throughout. The results obtained have been shown below :—

TABLE V

Days from sowing	Percentage increase in height	
	D 154	C.G.
46	100	100
53	130·7	137·0
60	151·5	177·7
67	175·2	194·0
74	197·6	217·0
81	218·9	237·9
88	238·2	258·0
95	251·7	273·0
102	271·1	287·4
109	282·2	292·6
123	284·7	302·2
130	284·8	302·5

(*ii*) *Variations in Dry Weight.*—

The variations in growth of the main stem as indicated by changes in dry weight showed that the amount of dry material in the basal regions was always more than in the apical portions. The addition of dry material towards the apical region gradually increased with the growth of the main stem in height. In any particular region or level of the stem the dry material increased with the advance of the growing season. So the maximum dry matter was found in all the regions in the advanced stage of 121 days growth. The above sequence of changes was found both in *capsularis* and *olitorius* with specific differences, at different stages, such as showing more dry weight in *capsularis* in the vegetative stage than in *olitorius*. However considering the total dry weight at different stages, it was seen that the rate of addition of dry material was quicker in *olitorius* than in *capsularis* which resulted in the formation of more dry material in *olitorius* in later stages. The

changes in dry matter at different heights of the plant and at different stages have been given in Table No. VI.

TABLE VI.

Showing variation in dry material.

Height of the stem	D 154				Chinsurah Green			
	Dry weight in gms.				Dry weight in gms.			
	I	II	III	IV	I	II	III	IV
0– 6″	0·896	1·273	2·302	3·707	0·691	1·566	2·171	3·547
6″–12″	0·579	0·915	1·684	2·862	0·468	1·196	1·728	2·884
12″–18″	0·401	0·741	1·424	2·549	0·265	1·007	1·499	2·645
18″–24″	0·324	0·611	1·263	2·313	0·141	0·873	1·340	2·483
24″–30″	0·236	0·517	1·107	2·109	0·121	0·746	1·245	2·329
30″–36″	...	0·423	0·976	1·899	...	0·645	1·086	2·190
36″–42″	...	0·306	0·802	1·616	...	0·523	0·985	2.070
42″–48″	...	0·229	0·677	1·550	...	0·419	0·857	1·951
48″–54″	...	...	0·531	1·378	...	...	0·749	1·808
54″–60″	...	...	0·445	1·193	...	...	0·629	1·666
60″–66″	...	...	0·366	1·030	...	...	0·525	1·538
66″–72″	...	...	0·353	0·854	...	...	0·529	1·378
72″–78″	...	...	...	0·708	...	...	...	1.271
Total dry wt. ...	2·436	5·015	11·930	23·768	1·686	6·975	13·343	29·706

I—51 days from sowing corresponded to vegetative stage.
II—72 days from sowing corresponded to bud stage.
III—93 days from sowing corresponded to flowering stage.
IV—121 days from sowing corresponded to pod stage.

(*iii*) *Variations in moisture content.*—

The moisture content in the stem varied from top to bottom. The calculated percentage of moisture variations on dry weight showed a gradual increase from base of the stem towards the apical regions. The highest moisture content was noticed, throughout the season, in the growing region of the apex showing close relation of moisture content with apical growth. The demand of moisture was more in the vegetative phase of the

plant than in later stages. With the increase in secondary growth in the basal regions, the moisture percentage showed a decrease. When the moisture content of a particular region in the stem was traced throughout the season, a gradual decrease was noticed from vegetative phase to the pod stage. The sequence of changes was similar in both *capsularis* and *olitorius* with specific differences. From the total moisture variations in the whole length of the stem, it was found that the total moisture content was more or less of the same order in both the species during the progress of the season. The results have been given in the Table No. VII.

TABLE VII.

Variation in moisture % in terms of dry weight.

Height of the Stem	D 154				Chinsurah Green			
	% of moisture in terms of dry wt.				% of moisture in terms of dry wt.			
	I	II	III	IV	I	II	III	IV
0–6″ ...	317·07	295·68	241·53	196·80	245·30	222·67	195·67	157·20
6″–12″ ...	362·00	305·57	235·62	198·70	313·36	241·81	205·90	167·34
12″–18″ ...	384·50	322·67	245·72	198·00	496·23	248·06	205·87	162·08
18″–24″ ...	402·16	236·40	246·60	199·90	811·35	263·00	212·16	161·78
24″–30″ ...	519·50	341·97	253·40	200·30	847·93	268·23	209 32	160 33
30″–36″ ...	...	365·24	248·66	197·70	...	277·98	225·32	160·18
36″–42″ ...	...	414·70	265·33	207·70	...	288·72	223·45	159·81
42″–48″ ...	...	495·19	281·20	190·00	...	292·12	201·98	107·78
48″–54″ ...	...	...	295·60	198 10	...	...	232·58	163·99
54″–60″ ...	...	...	304·00	205 10	...	...	245·63	166·93
60″–66″ ...	...	...	336·80	214·50	...	...	268·95	169·90
66″–72″ ...	...	...	289·20	229·50	...	...	291·49	174·67
72″–78″ ...	...	...	...	215·70	...	...	...	181·02

I—51 days from sowing corresponded to vegetative stage.
II—72 days from sowing corresponded to bud stage.
III—93 days from sowing correspopded to flowering stage.
IV—121 days from sowing corresponded to pod stage.

(iv) Comparative variations in the growth of the bark in relation to the formation of wood.—

The growth rates have been measured in terms of dry weight. The results have been tabulated in Table VIII.

TABLE VIII.

Mean weight of bark in gms.

Capsularis (D 154)

Height of the stem.	51 days		72 days		93 days		121 days	
0 - 6″ ...	0·480	± 0·046	0·688	± 0·016	1·025	± 0·056	1·570	± 0·119
6″ - 12″ ...	0·300	± 0·030	0·481	± 0·026	0·747	± 0·043	1·172	± 0·075
12″ - 18″ ...	0·206	± 0·022	0·376	± 0·021	0·728	± 0·033	1·147	± 0·089
18″ - 24″ ...	0·168	± 0·011	0·306	± 0·020	0·658	± 0·029	1·063	± 0·069
24″ - 30″ ...	0·120	± 0·008	0·270	± 0·018	0·569	± 0·023	0·952	± 0·069
30″ - 36″ ...	...	...	0·220	± 0·026	0·516	± 0·023	0·843	± 0·046
3½″ - 42″ ...	...	...	0·161	± 0·016	0·432	± 0·014	0·651	± 0·090
42″ - 48″ ...	...	...	0·122	± 0·014	0·366	± 0·008	0·713	± 0·034
48″ - 54″ ...	...	...	...	...	0·300	± 0·018	0·629	± 0·025
54″ - 60″ ...	...	...	...	...	0·248	± 0·011	0·553	± 0·020
60″ - 66″ ...	..	...	...	...	0·205	± 0·011	0·497	± 0·014
66″ - 72″ ...	...	...	...	...	0·187	± 0·026	0·420	± 0·016
72″ - 78″ ...	...	...	...	...	...	...	0·349	± 0·008
Total bark ...	1·274		2·623		5·981		10·900	

Olitorius (C. G.)

Height of the stem.	51 days		72 days		93 days		121 days	
0 - 6″ ...	0·351	± 0·018	0·735	± 0·032	0·956	± 0·033	1·319	± 0·070
6″ - 12″ ...	0·226	± 0·014	0·576	± 0·020	0·783	± 0·026	1·125	± 0·059
12″ - 18″ ...	0·173	± 0·016	0·465	± 0·018	0·745	± 0·026	1·112	± 0·053
18″ - 24″ ...	0·153	± 0·008	0·407	± 0·018	0·653	± 0·022	1·042	± 0·049
24″ - 30″ ...	0·119	± 0·011	0·356	± 0·020	0·635	± 0·020	0·992	∓ 0·023
30″ - 36″ ...	...	...	0·319	± 0·016	0·536	± 0·008	0·931	± 0·032
36″ - 42″ ...	...	...	0·260	± 0·011	0·497	± 0·014	0.904	± 0·035
42″ - 48″ ...	...	...	0·202	± 0·008	0·445	± 0·011	0·840	± 0·029
48″ - 54″ ...	...	...	...	...	0·400	± 0·014	0·790	± 0·026
54″ - 60″ ...	...	...	...	...	0·335	± 0·018	0·733	± 0·020
60″ - 66″ ...	...	...	...	...	0·285	± 0·020	0·666	± 0·020
66″ - 72″ ...	...	...	...	...	0·253	± 0·028	0·617	± 0·018
72″ - 78″ ...	...	...	...	...	...	...	0·552	± 0·040
Total bark ...	1·022		3·652		6·523		13·377	

51 days from sowing corresponded to vegetative stage.
72 ,, ,, ,, ,, ,, bud ,,
93 ,, ,, ,, ,, ,, flowering ,,
121 ,, ,, ,, ,, ,, pod ,,

The above results showed great variations but the sequence of changes showed a definite tendency in both *capsularis* and *olitorius*, as for instance the amount of the bark was found to be greater in the basal regions, which gradually decreased towards the apical regions, and this tendency was maintained throughout the growing season. The fibre was laid gradually from the base towards the apex as the stem grew in height. The same was true in both the species, with the difference that the rate of growth was different in different species, in different zones. The quantity of bark as shown by dry weight at different heights of the stem varied from vegetative to bud stage and then to the pod stage.

The maximum dry weight of bark was found to have developed in the basal regions, but the rate of development varied in both the species. In the basal regions of the vegetative stage the dry weight of bark was found to be more in D 154 than in C. G. In later stages C. G. showed higher higher values of bark than D 154. Even in subsequent zones at higher levels on the stem, C. G. showed a greater value of mean bark weights than in D 154. As noted above in a single stem of course the mean bark value decreased from bottom towards the apical regions.

The comparative values of rate of growth of bark at different stages in C.G. and in D 154 have been worked out. The rate of fibre growth from early vegetative stage to the bud stage was found to be more in C. G. than in D 154. But the rates later on increased in D 154 from bud stage to the flowering stage, where it reached the maximum and slowed down in the pod stage. So C. G. recorded more vigorous rate of fibre growth earlier than in D 154, which completed the same at later stage. These facts have been clearly brought out by the results on the ratio of the formation of bark and wood later shown in Table XII.

The total output of bark at different stages of the plant along the whole stem at difinite heights showed interesting

variations as shown in the Table IX giving the percentage of bark in terms of dry weight at different stages.

TABLE IX.

Percentage of bark in terms of dry weight.

	Chinsurah Green				D 154			
	I	II	III	IV	I	II	III	IV
(1) Total length of the stem taken ...	30″	48″	72″	78″	30″	48″	72″	78″
(2) Total dry weight ...	1·686	6·975	13·343	29·706	2·436	5·015	11·930	23·768
(3) Total bark weight	1·022	3·652	6·523	13·377	1·274	2·623	5·981	10·900
(4) % of bark in terms of dry weight ...	60·60	48·30	48·90	42·70	52·30	52·30	50·10	44·80

I – 51 days from sowing corresponded to vegetative stage.

II – 72 ,, ,, ,, ,, ,, bud ,,

III – 93 ,, ,, ,, ,, ,, flowering ,,

IV – 121 ,, ,, ,, ,, ,, pod ,,

The above results indicated that the percentage of bark was found to be maximum in the first stage *i.e.* at the vegetative stage when compared with the total dry weight at that stage in both the species. This maximum value decreased in later stages thus showing that wood formation was less in the beginning, but its rate increased progressively in the season, but varying in the two species. In D 154 a higher percentage of bark per dry weight was maintained in later stages than in C.G.

By grouping the experimental 6″ regions into three broad regions of main stem as bottom, middle and top, the distribution of the different mean values of bark within these three groups has been calculated in terms of total dry weight of the bark of the whole length of the stem. The results obtained at different stages are given in Table X.

TABLE X.

Percentage distribution of bark calculated on total dry weight of bark of the stem.

	Chinsurah Green				D 154			
	I	II	III	IV	I	II	III	IV
Bottom ...	56·5	48·6	48·1	46·1	61·2	58·9	52·8	54·2
Middle ...	31·9	36·8	32·4	34·6	29·4	30·3	31·5	31·1
Top ...	11·6	14·6	19·5	19·3	9·4	10·8	15·7	14·7

I – 51 days from sowing corresponded to vegetative stage
II – 72 „ „ „ „ „ bud „
III – 93 „ „ „ „ „ flowering „
IV – 121 „ „ „ „ „ pod „

The above results confirmed the results discussed before on the distribution of bark along the length of the stem that bottom contained the maximum percentage of fibre, then the middle and then the top. An important difference in distribution of bark in C.G. and D 154 has been brought out from the above results to the effect that D154 showed higher bark content in the bottom than C.G. but C.G. showed higher contents in the middle and top regions.

Together with variations in bark it was interesting to study the corresponding variations in the growth and development of the wood. Wood formation in terms of dry weights, as expected, showed the same variation as found in bark values *i.e.* maximum development in the basal regions of the stem with gradual decrease up along the stem towards the apex (XI).

TABLE XI.

Mean wood weight at different heights in gms.

D 154

Height of the stem.	51 days		72 days		93 days		121 days	
0 – 6″ ...	0·416	±0·040	0·585	±0·021	1·277	±0·119	2·137	±0·125
6″–12″ ...	0·279	±0·026	0·434	±0·018	0·937	±0·051	1·690	±0·105
12″–18″ ...	0·195	±0·016	0·365	±0·018	0·696	±0·038	1·402	±0·059
18″–24″ ...	0·156	±0·014	0·305	±0·014	0·605	±0·034	1·250	±0·058
24″–30″ ...	0·116	±0·008	0·247	±0·011	0·538	±0·032	1·157	±0·046
30″–36″ ...	...	...	0·203	±0·008	0·460	±0·030	1·056	±0·038
36″–42″ ...	...	...	0·145	±0·004	0·370	±0·016	0·965	±0.035
42″–48″ ...	...	...	0·107	±0·004	0·311	±0·014	0·837	±0·029
48″–54″ ...	...	...	...	...	0·231	±0·021	0·749	±0·028
54″–60″ ...	...	...	...	...	0·197	±0·008	0·640	±0·023
60″–66″ ...	...	...	...	...	0·161	±0·021	0·533	±0·021
66″–72″ ...	...	...	...	...	0·160	±0·025	0·434	±0·018
72″–78″ ...	...	...	...	...	...	...	0·359	±0·018
Total wood ...	1·162		2·391		5·943		13·209	

Chinsurah Green.

Height of the stem.	51 days		72 days		93 days		121 days	
0 – 6″ ...	0·340	±0·020	0·831	±0·028	1·215	±0·034	2·228	±0·113
6″–12″ ...	0·242	±0·018	0·620	±0·020	0·945	±0·022	1·759	±0·083
12″–18″ ...	0·192	±0·011	0·542	±0·011	0·754	±0·021	1·533	±0·068
18″–24″ ...	0·133	±0·014	0·466	±0·008	0·687	±0·018	1·441	±0·060
24″–30″ ...	0·110	0·011	0·390	±0·021	0·610	±0·018	1·337	±0·053
30″–36″ ...	...	...	0·326	±0·008	0·550	±0·051	1·259	±0·048
36″–42″ ...	...	...	0·263	±0·011	0·488	±0·018	1·166	±0·045
42″–48″ ...	...	...	0·217	±0·021	0·412	±0·014	1·111	±0·044
48″–54″ ...	...	...	...	...	0·349	±0·018	1·018	±0·035
54″–60″ ...	...	...	...	...	0·294	±0·020	0·933	±0·023
60″–66″ ...	...	...	...	...	0·240	±0·020	0·872	±0·030
66″–72″ ...	...	...	...	...	0·276	±0·026	0·761	±0·023
72″–78″ ...	...	...	...	...	...	...	0·665	±0·016
Total wood...	1·017		3·655		6·820		16·083	

51 days from sowing corresponded to vegetative stage.

72 ,, ,, ,, ,, ,, bud ,,

93 ,, ,, ,, ,, ,, flowering ,,

121 ,, ,, ,, ,, ,, pod ,,

The results showed the similar sequence of changes in both D 154 and C. G. during the course of the season at different stages or along the main stem at any one time. The wood continued to grow and develop from the vegetative stage with minimum value to the maximum value in the pod stage.

From a study of the comparative values of the rate of formaton of wood at different stages in C. G. and D 154 it is found that the rate of wood growth from early vegetative to the bud stage was more in C.G. than in D 154; but the rate was increased in D154 in later stages from bud stage to flowering stage where it reached the maximum, and slowed down in the pod stage. The sequence of changes from stage to stage was the same, but the rate of early formation of wood in C.G. was more than in D154.

The sequence of changes in wood growth and bark growth are seen to be closely interrelated with each other. This interrelationship has been clearly brought forward by the results tabulated in Table XII where mean values of bark weights have been represented as ratio of unit value of wood formation.

TABLE XII.

Ratio of bark formation to that of wood formation.

Height of the stem.	D 154				Chinsurah Green			
	I	II	III	IV	I	II	III	IV
0–6″ ...	1·154	1·176	0·803	0·735	1·032	0·884	0·787	0·592
6″–12″ ...	1·075	1·108	0·797	0·693	0·934	0·929	0·829	0·640
12″–18″ ...	1·056	1·030	1·046	0·818	0·901	0·858	0·988	0·725
18″–24″ ...	1·077	1·003	1·088	0·850	1·150	0·873	0·951	0·723
24″–30″ ...	1·034	1·093	1·058	0·823	1·082	0·913	1·041	0·742
30″–36″ ...	...	1·084	1·122	0·798	...	0·979	0·975	0·739
36″–42″ ...	...	1·110	1·168	0·675	...	0·989	1·018	0·775
42″–48″ ...	...	1·140	1·177	0·852	...	0·931	1·080	0·756
48″–54″ ...	...	...	1·299	0·840	...	...	1·146	0·776
54″–60″ ...	...	...	1·259	0·864	...	...	1·159	0·786
60″–66″ ...	...	...	1·273	0·932	...	...	1·188	0·764
66″–72″ ...	...	...	1·127	0·968	...	...	0·917	0·311
72″–78″ ...	...	...	...	0·972	...	...	...	0·830

I–51 days from sowing corresponded to vegetative stage.
II–72 ,, ,, ,, ,, ,, bud ,,
III–93 ,, ,, ,, ,, ,, flowering ,,
IV–121 ,, ,, ,, ,, ,, pod ,,

The values tabulated above showed clearly the sequence of changes in bark lay out in relation to formation of wood during the season and also at different heights of the main stem. The important results found were (*i*) that the weight of bark exceeded that of wood in the vegetative stage, bud stage and flowering stage, (*ii*) in pod stage the weight of wood exceeded that of bark, (*iii*) the ratio was differently maintained on the stem according to the stage and height of the plant *i.e.* secondary wood formation took place from the bottom and advanced up the stem, thus shifting the fibre ratio towards the apex, (*iv*) more fibre was laid in the upper regions of the stem during the flowering stage, (*v*) both D154 and C. G. behaved similarly, in a general way, with specific differences, (*vi*) the specific difference noted from the comparative rates of growth of wood and bark was that the vigour of growth was more in C. G. in earlier vegetative stages than in D154. But D154 showed the same vigour in later stages of bud to flowering periods when the maximum fibre ratio was also recorded. Throughout the changes in bark growth and wood formation a definite ratio was maintained which in the present studies varied from 0.6 to 1.2 in C.G. and 0.7 to 1.3 in D154 which is almost the same in both the species, showing a close co-ordination between bark and wood formation.

Similar results on other 8 varieties are still in course of analysis and preparation.

V. JUTE AGRONOMY.

1. Growing jute as a row crop.—

To study the possibilities and economics of growing jute as a row crop as against the usual broadcast growing two trials, one with *capsularis* and the other with *olitorius* jute were carried out during the year. The spacing treatments studied in both the trials were light thinning × 12 inches, 2 inches × 12 inches, 3 inches × 12 inches, 4 inches × 12 inches and broadcast as control.

The data on yield, cost of production and profit values for each treatment in the two trials are given below in Table XIII and Table XIV.

TABLE XIII.

C. capsularis (D 154)

Layout—Replicated randomized blocks in 5 replications.
Effective plot size—0·0156 acre.
Sown on 16-4-50 & harvested on 31-8-50 at small pod stage.

Spacing treatments	Cost of cultivation per acre (% on control)	Yield per acre. (in mds.)	Profit % on control
(A) Broadcast (control) ...	100·00	18·22	100·00
(B) Light thinning × 12″	87·50	22·10	131·36
(C) 2″ × 12″ ...	85·50	21·65	128·75
(D) 3″ × 12″ ...	87·30	21·81	129·20
(E) 4″ × 12″ ...	85·80	21·54	127·90
		P – 0·01	
		S. E.% – 2·22	
		C. D. – 1·93	

TABLE XIV.

C. olitorius (C. G)

Layout—Replicated randomized blocks in 6 replications.
Effective plot size—0·0085 acre.
Sown on 19-5-50 and harvested on 7-10-50 at small pod stage

Spacing treatments	Cost of cultivation per acre (% on control)	Yield per acre. (in mds.)	Profit on control
(A) Broadcast ...	100·00	13·19	100·00
(B) Light thinning × 12″	83·94	12·96	102·92
(C) 2″ × 12″ ...	82·21	12·54	99·25
(D) 3″ × 12″ ...	84·66	12·71	100·17
(E) 4″ × 12″ ...	84·04	12·48	98·06
		P – Large	
		S. E.% – 4·72	

It will be seen from Table XIII that the cost of production in line plots in *capsularis* is reduced by about 15% and yield in line plots has increased by 3—4 maunds per acre against broadcast plots resulting in higher profit values in line plots (18 to 20%) against usual broadcast growing of jute.

In the *olitorius* trial, there was a reduction of about 15% in the cost of production in line plots against broadcast plots. The crop, however, suffered very badly due to drought immediately after sowing and continued rains thereafter, resulting in stunted growth and poor yields.

2. Manurial Trials.—

(*i*) To study the effects on yield and quality of fibre of varying doses of Nitrogen and Potash and their combinations and to compare yield effects of organic manures and inorganic fertilizers, two trials one with *capsularis* and another with *olitorius* were laid out during the season in heavy clay soil at Chinsurah Farm. Fertilizers applied, yield of fibre, stand, green weight obtained per acre for respective treatments are given below separately for each trial.

TABLE XV.

C. capsularis (D154)

Layout—Replicated randomized blocks in 6 replications.
Effective plot size—0·0025 acre.
Sown on 5.5.50 and harvested on 12.9.50.

Treatments	Yield per acre in maunds	Percent yield on control	Cost of fertilizer per acre
			Rs. As. P.
1. N_2K_1 ...	28·87	152·54	37 0 0
2. N_2 ...	27·97	147·78	29 0 0
3. N_1K_2 ...	26·75	141·35	30 8 0
4. $Compost_2$ ...	26·65	140·81	*26 4 0
5. N_2K_2 ...	25·10	132·61	45 0 0
6. N_1K_1 ...	23·62	124·81	22 8 0
7. $Compost_1$ ...	22·78	117·04	*13 2 0
8. N_1 ...	22·00	116·29	14 8 0
9. S_1 ...	21·58	114·03	*13 2 0
10. FYM_1 ...	21·21	112·07	25 0 0
11. S_2 ...	20·73	109·56	*26 4 0
12. FYM_2 ...	20·62	108·93	50 0 0
13. K_2 ...	19·83	104·76	16 0 0
14. No manure ...	18·92	100·00	...
15. K_1 ...	18·45	97·45	8 0 0
P. ...	0·01	...	...
S.E.% ...	5·01	...	...
C.D. ...	5·66	..	...

TABLE XVI.

C. olitorious (C. G.)

Layout—Replicated randomized blocks in 6 replications.
Effective plot size—0·0025 acre.
Sown on 18-5-50, and harvested on 1-10-50.

	Treatments	Yield per acre in maunds	Percent yield on control	Cost of fertiliser per acre
				Rs. A. P.
1.	$N_2^3 K_1$ ...	18·85	178·49	37 0 0
2.	$N_2 K_2$ ...	16·30	154·34	45 0 0
3.	$Compost_2$ ...	14·28	135·22	*26 4 0
4.	$Compost_1$ ...	13·71	129·82	*13 2 0
5.	K_1 ...	13·64	129·16	8 0 0
6.	N_2 ...	13·42	127·07	29 0 0
7.	$N_1 K_2$ ...	13·28	125·75	30 8 0
8.	N_1 ...	12·71	120·35	14 8 0
9.	$Sludge_2$ ...	12·26	116·09	*26 4 0
10.	FYM_2 ...	12·08	114·39	50 0 0
11.	$Sludge_1$ ...	11·64	110·22	*13 2 0
12.	$N_1 K_1$ ...	10·85	103·02	22 8 0
13.	Control (No manure) ...	10·56	100·00	—
14.	K_2 ...	10·39	98·38	16 0 0
15.	FYM_1 ...	9·81	92·89	25 0 0
	P ...	0·01		
	S. E. % ...	11·76		
	C. D. ...	6·50		

N_1 — Ammonium sulphate @ 20 lbs N per acre.

K_1 — Muriate of potash @ 25 lbs K_2O per acre.

Compost — 62.5 mds per acre or 20 lbs N per acre on 50% availability basis.

Sludge — 62·5 mds per acre or 20 lbs N per acre on 50% availability basis

FYM — 100 mds per acre or 20 lbs N per acre on 50% availability basis

* Compost and sludge were obtained free from Agriculture Department, Government of West Bengal and the cost is not known. Only the transport charges were paid as mentioned in the respective columns.

Conclusions.—In *capsularis* response to Nitrogen was positive. N_2K_1 gave the highest yield closely followed by N_2, N_1K_2 and $Compost_2$. N gave much higher yield than K. Combinations of N & K gave somewhat better results. Of the organic sources of nitrogen, compost proved to be the best. The *olitorius* crop was not very satisfactory due to unfavourable weather conditions after sowing. The stand suffered considerably. In *olitorius* response to Nitrogen was positive. K in combination with N generally gave higher yields. K_1 alone in *olitorius* also improved the yield considerably whereas K_2 suppressed the yield. For N, inorganic sources and compost were found better than sludge and F.Y.M.

To study the average height, base diameter, green weight etc. of plants under different manurial treatments in both D154 and C.G. manurial trials 10 random plants per plot or 60 plants per treatment were selected for study. The data are given in Tables XVII and XVIII

TABLE XVII.

C. capsularis (D 154.)

Average height, base diameter, green weight, etc. of plants in the different treatments. (Based on 10 random plants per plot or 60 plants per treatment.)

Treatments	Plant height (inches)	Base diameter (cm)	Green Wt. per plant (gms.)	Fibre Wt. per plant (gms.)	Wt. of leaves & branches (non-fibre producing portion of plant (gms.)	Wt. of clean stem per plant (gms.)	Wt. of jute stick per plant (gms.)	Ratio of fibre to green weight of plant in per cent.
N_2K_1 ...	114·7	2·19	2601·66	151·8	430·6	2150·0	355·3	5·83
N_2 ...	112·4	2·08	2395·00	151·7	379·1	1993·3	351·5	6·33
N_1K_2 ...	113·8	2·17	2483·66	115·8	387·5	2078·3	370·0	4·66
C_2 ...	110·8	2·11	2433·33	160·8	370·0	2063·3	384·0	6·61
N_2K_2 ...	109·2	1·94	2115·00	130·8	325·8	1768·3	314·7	6·18
N_1K_1 ...	105·8	1·93	1933·33	112·5	337·1	1578·3	273·1	5·82
C_1 ...	97·9	1·77	1625·00	114·5	249·1	1310·0	230·5	7·05
N_1 ...	103·0	1·88	1786·66	110·8	283·0	1483·3	267·0	6·20
S_1 ...	98·0	1·69	1497·50	85·8	271·2	1208·3	213·3	5·73
FYM_1 ...	103·0	1·90	1780·00	109·8	291·5	1468·3	257·5	6·17
S_2 ...	102·6	1·99	1875·00	116·3	317·5	1535·0	273·6	6·20
FYM_2 ...	105·7	1·96	1955·00	120·0	315·1	1621·6	276·8	6·14
K_2 ...	100·9	1·90	1938·33	121·7	326·3	1593·3	282·3	6·28
No manure	97·9	1·74	1385·00	87·5	211·7	1155·0	236·3	6·32
K_1 ...	97·1	1·77	1445·00	96·0	239·0	1285·6	225·6	6·21

TABLE XVIII.

C. olitorius (C. G.)

Average height, based diameter, green weight etc. of plants in the different treatments.
(Based on 10 random plants per plot or 60 plants per treatment)

Treatments	Plant height (inches)	Base diameter (cm)	Green Wt. per plant (gms)	Fibre Wt. per plant (gms)	Wt. of leaves & branches non-fibre producing portion of plant (gms)	Wt. of clean stem per plant (gms)	Wt. of jute stick per plant (gms)	Ratio of fibre to Green weight of plant in per cent.
N_2K_1 ...	114·90	1·97	4462·81	191·83	1392·63	3053·33	657·00	4·29
N_2K_2 ...	116·80	1·93	4190·83	196·00	1251·66	2906·32	648·50	4·68
C_2 ...	118·00	2·23	5391·66	232·16	1726·66	3635·63	754·66	4·31
C_1 ...	111·60	1·91	3994·17	186·83	1324·16	2632·00	590·00	4·68
K_1 ...	114·10	1·93	4536·66	204·83	1461·66	3058·33	634·33	4·51
N_2 ...	113·40	2·05	4708·33	216·00	1468·33	3231·66	714·16	4·89
N_1K ...	110·70	1·88	3469·16	167·33	1101·66	2359·16	574·00	4·82
N_1 ...	112·07	2·01	4745·00	229·00	1569·16	3155·83	630·16	4·83
S_2 ...	115·50	1·93	4252·00	205·50	1031·66	3191·16	667·50	4·83
FYM_2 ...	109·00	1·90	4177·50	199·60	1296·33	2851·66	607·50	4·78
S_1 ...	109·90	1·81	3640·83	176·83	1110·00	2515·63	543·33	4·86
N_1K_1 ...	109·50	2·00	4687·00	206·63	1606·66	3045·00	615·66	4·41
No manure ...	106·30	1·90	4175·00	195·16	1460·00	2696·66	534·50	4·67
K_2 ...	109·05	1·87	4708·30	170·66	1242·00	2635·00	551·60	3·62
FYM_1 ...	109·40	2·01	4760·00	208·50	1392·50	3016·33	684·16	4·40

Conclusions.—(*a*) Nitrogen from both inorganic and organic sources has generally been found to improve the plant height, base diameter, green weight etc.

(*b*) Fibre percentage was more fluctuating in *capsularis* than *olitorius* which had more constant fibre percentage under different manurial treatments. This would suggest that the crop is more uniform in *olitorius* than in *capsularis*.

(*ii*) *Application of fertilizers in instalments 1950-51.*— To study the effects of time of application of fertilizer (Ammonium sulphate) in *instalments* on yield and quality of jute fibre, two trials one with *capsularis* and another with *olitorius* were conducted at Chinsurah Farm in 1950-51.

The treatments *were same* in both the trials and were as follows:—

(*a*) 20 lbs. N in one instalment along with sowing (Control).

(*b*) 20 lbs. N in one instalment as top-dressing after 1st weeding.

(*c*) 10 lbs. N along with sowing plus 10 lbs. N after 1st weeding.

(*d*) 6·7 lbs. N along with sowing plus 6·7 lbs. N after 1st weeding plus 6·7 lbs. N after 2nd weeding.

(*e*) 10 lbs. N after 1st weeding plus 10 lbs. N after 2nd weeding.

(*f*) 6·7 lbs. N after 1st weeding plus 6·7 lbs. N after 2nd weeding plus 6·7 lbs. N after 3rd weeding.

The fibre samples were sent to Technological Research Laboratories, Tollygunge for technological tests. The data on fibre yield are given below in Tables XIX and XX.

TABLE XIX

C. capsularis (D 154)

Layout—Replicated randomized blocks in 4 replications.
Effective plot size—0.00011 acre.
Sown on 13.5.50 and harvested on 15.9.50.

Treatments	Yield per acre in mds.	% on control.
(*a*) 20 lbs. N in one instalment along with sowing	17.93	100.00
(*b*) 20 lbs. N in one instalment as top-dressing after first weeding ...	19.54	108.98
(*c*) 10 lbs. N along with sowing and 10 lbs. N after first weeding ...	20.84	116.23
(*d*) 6.7 lbs. N along with sowing, 6.7 lbs. N after first weeding and 6.7 lbs. N after second weeding	20.47	114.16
(*e*) 10 lbs. N after first weeding and 10 lbs. after second weeding	20.23	112.83
(*f*) 6.7 lbs. N after first weeding, 6.7 lbs. N after second weeding and 6.7 lbs. N after third weeding	21.95	122.42
P — large		
S.E.% — 11.21		

TABLE XX

C. olitorius (*C.G.*)

Layout—Replicated randomized blocks in 4 replications.
Effective plot size—0.00011 acre.
Sown on 22.5.50 and harvested on 6.10.50

Treatments	Yield per acre in mds.	% on control.
(*a*) 20 lbs. N in one instalment along with sowing	10.07	100.00
(*b*) 20 lbs. N in one instalment as top-dressing after 1st weeding ...	8.56	84.01
(*c*) 10 lbs. N along with sowing and 10 lbs. N after first weeding ...	8.63	85.70
(*d*) 6.7 lbs. N along with sowing, 6.7 lbs. N after first weeding and 6.7 lbs. N after second weeding	12.63	125.42
(*e*) 10 lbs. N after first weeding and 10 lbs. N after second weeding	15.11	150.05
(*f*) 6.7 lbs. N after first weeding, 6.7 lbs. N after second weeding and 6.7 lbs. N after third weeding	13.77	137.70
P — 0.05		
S.E.% — 6.50		
C.D. — 2.23		

The yields of fibre obtained in both the trials particularly in *olitorius* were rather low because of adverse weather conditions prevailing immediately after sowing, which resulted in stunted growth of the crop and thereby lowering the yield.

Instalment application of fertilizer proved better in both the trials though the treatment differences in *capsularis* were insignificant. The applicaiton of fertilizer in instalments after 1st and 2nd weeding has given the best result.

(*iii*) *Comparative merits of inorganic nitrogenous fertilizers with jute.*—To study the comparative merits of inorganic nitrogenous fertilizers on yield and quality of fibre, two trials, one with *capsularis* and another with *olitorius* in randomized blocks layout were carried out during the season at Chinsurah Farm. Fertilizers were applied in two equal instalments: (*i*) just before sowing and (*ii*) as top-dressing when the crops were two months old. The results thereof are given below in Tables XXI and XXII.

TABLE XXI.

C. capsularis (D 154)

Layout – Replicated randomized blocks in 4 replications.
Effective plot size – 0·00137 acre.
Sown on 14-5-50 and harvested on 16-9-50.

Treatments		Fibre yield per acre in maunds.	Percent on control
Ammonium Sulphate (Control) ...	30 lbs N	23·59	100·00
Ammonium Sulphate ...	60 lbs N	29·20	123·78
Sodium nitrate ...	30 lbs N	24·32	103·09
Sodium nitrate ...	60 lbs N	27·46	116·41
Ammonium nitrate ...	30 lbs N	25·26	107·08
Ammonium nitrate ...	60 lbs N	27 44	116·32
Potassium nitrate ...	30 lbs N	25·52	108·11
Potassium nitrate ...	60 lbs N	31·11	131·88
	P	— Large	
	S. E.%	— 6·44	

TABLE XXII

C. olitorius (C. G.)

Layout – Replicated randomized blocks in 4 replications.
Effective plot size – 0·00137 acre.
Sown on 14-5-50 and harvested on 9-10-50.

Treatments		Yield per acre in mds.	Percent on control.
Ammonium sulphate (Control) ...	30 lbs N	19·48	100·00
Ammonium sulphate ...	60 lbs N	27·56	141·48
Sodium nitrate ...	30 lbs N	19·86	101·95
Sodium nitrate ...	60 lbs N	21·81	111 91
Ammonium nitrate ...	30 lbs N	15·76	80·90
Ammonium nitrate ...	60 lbs N	23·31	119·66
Potassium nitrate ...	30 lbs N	17·55	90·09
Potassium nitrate ...	60 lbs N	23·25	119·35
	P	... Large	
	S. E.%	... 18·7	

Conclusion:—No significant differences between the different nitrogenous fertilizers were observed.

Though insignificant, higher yields were obtained in *capsularis* with Potassium nitrate and in *olitorius* with ammonium sulphate.

3. Triple-cropping jute lands.—

To study the possibilities of growing three crops on a land in the same year under Chinsurah conditions, with jute as the first crop, two trials were conducted, one with *olitorius* and the other with *capsularis jute.*

(*a*) *Triple-cropping with capsularis.*—The treatments included two varieties of *capsularis* jute—one early (Fanduk) and the other late (D 154) with three stages of harvest, *i.e.* before bud, bud and flower stages followed by two varieties of paddy—an early (Badkalm-kati) and late one (Tilak-kachary). Transplanting of paddy was done on the fourth day after each stage of harvest of jute. Gram as the 3rd crop was sown after the harvest of paddy. One irrigation was necessary to raise the 3rd crop of gram as the land was very dry after paddy harvest. The treatments of jute and paddy alone were also

included. Yield of three crops—Jute, Paddy and Gram are given in Table XXIII.

Studies of chemical examination of soils before and after each crop were also included to find out the extent of soil exhaustion after growing of three successive crops on the same land. The chemical analyses data indicated that soil exhaustion was nil or negligible due to jute. Soil exhaustion studies will be continued next year for verification.

(*b*) *Triple-cropping with olitorius*—The treatments included improved strain of jute O39-620, three stages of harvest of jute crop, *i.e.* before bud, bud stage and flower stage. Two varieties of paddy—an early (Badkalamkati) and late (Patnai) followed jute as the second crop which was transplanted on 3rd day after each harvest of jute crop. Khesari as the 3rd crop was sown on the standing paddy crop. The treatments of jute and paddy alone as single crop were also included.

The yield of jute crop was low due to drought at the early stage of crop growth as well as severe mite attack. The combined effect of these resulted in a stunted growth of jute crop. Yield of three crops—Jute, paddy and khesari are given in Table XXIV. Studies of chemical examination of soils before and after each crop were also included in order to study the extent of soil exhaustion by the different cropping.

Conclusion.—It will be seen from the data in both the trials that the yield of fibre in jute was more from late stage of harvest. Late variety of jute has given higher yield than early jute. Maximum paddy yield was obtained from plots where paddy was transplanted earlier (*i.e.* plots released from pre-bud stage of harvest of jute). Higher yields of paddy were obtained from late varieties than early varieties. The yield of gram as the 3rd crop with *capsularis* jute was higher in plots where jute was harvested earlier.

When the combined value of jute, paddy and gram or khesari was considered, maximum return from produce in terms of money was obtained from flower stage harvest of first crop (jute).

In view of the above, it may be concluded that the late variety of jute, late paddy and any pulse crop (gram or khesari) form a suitable and profitable sequence of crops in triple-cropping schemes.

TABLE XXIII

C. capsularis—*D 154* (*late*) *and Fanduk* (*early*)

Effective plot size—0·005 acre
Date of sowing Jute—17-4-50
Dates of harvesting (jute): D154 ... 31-7-50, 21-8-50, 9 9-50 and 22-9-50.
Fanduk ... 18-7-50, 31-7-50, 12-8-50 and 30-8-50.
Dates of Transplanting paddy ... 11-7-50, 21-7-50, 3-8-50, 14-8-50, 24-8-50 and 13-9-50.

Treatments.	Jute as 1st crop yield per acre in mds.	Paddy as 2nd crop yield per acre in mds.		Gram as 3rd crop yield per acre in mds.	Value of produce per acre			Total value of produce per treatment per acre.
		Early	Late		Jute @ Rs. 50/- per md.	Paddy @ Rs. 10/- per md.	Gram @ Rs. 15/- per md.	
					Rs. A.P.	Rs. A.P.	Rs. A.P.	Rs. A.P.
A	20·1	21·6	—	9·04	1005 0 0	260 4 0	135 9 0	1403 13 0
B	20·3	—	28·9	8·88	1015 0 0	368 0 0	133 3 0	1516 3 0
C	24·1	14·8	—	7·46	1205 0 0	176 6 0	111 14 0	1413 4 0
D	25·5	—	20·2	4·18	1275 0 0	261 9 0	62 10 0	1599 3 0
E	26·3	9·2	—	4·26	1315 0 0	109 6 0	63 14 0	1488 4 0
F	26·5	—	15·2	6.54	1325 0 0	192 3 0	98 6 0	1615 9 0
G	16·4	14·8	—	9·04	656 0 0	199 14 0	135 0 0	990 14 0
H	19·7	—	36·0	9·45	985 0 0	481 8 0	141 12 0	1608 4 0
I	19·8	17·5	—	9·62	990 0 0	219 2 0	144 4 0	1353 6 0
J	19·5	—	30·8	9·75	975 0 0	351 14 0	146 4 0	1473 2 0
K	20·3	17·9	—	8·88	1015 0 0	210 12 0	133 3 0	1358 15 0
L	20·0	—	23·9	5·51	1000 0 0	313 8 0	82 0 0	1395 8 0
M	28·2	—	—	—	1410 0 0	—	—	1410 0 0
N	25·5	—	—	—	1275 0 0	—	—	1275 0 0
O	—	17·0	—	—	—	246 3 0	—	246 3 0
P	—	—	32·8	—	—	448 4 0	—	448 4 0

Treatments: A and B (D154)—harvest at pre-bud stage on 31-7-50 ;
" C and D (D154)—harvest at bud stage on 21-8-50 ;
" E and F (D154)—harvest at flower stage on 9-9-50 ;
" G and H (Fanduk)—harvest at pre-bud stage on 18-7-50 ;
" I and J (Fanduk)—harvest at bud stage on 31-7-50 ;
" K and L (Fanduk)—harvest at flower stage on 12-8-50 ;
" M-D154 alone—harvest at pod stage on 22-9-50 ;
" N-Fanduk alone—harvest at pod stage on 30-8-50 ;
" O-Early paddy alone ;
" P-Late paddy alone.

TABLE XXIV

C. olitorius (*O39 620*)

Effective plot size—0·00514 acre.
Date of sowing jute—14-5-50.
Dates of harvesting jute—29-8-50, 12 9-50, 26-9-50 and 9-10-50.
Dates of transplanting paddy—11-7-50, 31-8-50, 14-9-50 and 29-9-50.

Treatments	Jute as 1st crop yield per acre in mds.	Paddy as 2nd crop yield per acre in mds.		Khesari as 3rd crop yield per acre in mds.	Value of produee per acre.			Total value of produce per treatment per acre
		Early	Late		Jute @ Rs. 50 per md.	Paddy @ Rs. 10 per md.	Khesari @ Rs. 12/- per md.	
					Rs. A.	Rs. A.	Rs. A.	Rs. A.
A	13·1	8·9	...	10·93	655 0	115 9	131 2	901 12
B	14·4	...	21·4	9·92	720 0	272 11	119 0	1,111 11
C	16·7	8·3	...	12·26	835 0	102 6	147 2	1,084 8
D	17·3	...	12·2	10·24	865 0	185 8	122 14	1,173 6
E	19·5	5·6	...	11·14	975 0	92 14	133 11	1,201 9
F	19·0	...	7·1	12·84	950 0	89 14	154 3	1,194 1
G	19·7	...	...	...	985 0	...	...	985 0
H	...	18·8	...	...	...	269 14	...	269 14
I	...	...	32·0	...	...	422 3	...	422 3

Treatments:
A & B ... Harvest at pre-bud stage on 29-8-50.
C & D ... Harvest at bud stage on 12-9-50.
E & F ... Harvest at flower stage on 26-9-50.
G ... Jute alone, harvest at pod stage on 9-10-50.
H ... Early paddy alone.
I ... Late paddy alone.

4. Double cropping in low-lands with jute as the 1st crop.—

To study the possibilities of growing jute as an earlier additional crop in the low lands, an experiment was conducted with an early (Fanduk) and a late (D154) variety of jute followed by a deep water paddy (Tilak-kachary).

Studies of chemical examination of soil before and after each crop were also included to know the soil exhaustion, if any.

The data on yields and values from both jute and paddy are given in Table XXV.

Late jute has done better than early jute. The jute harvested at a late stage has given the highest yield and maximum return in terms of money. The maximum paddy yield was obtained from the plots when the paddy was transplanted earlier.

Highest return from the land was obtained from combined crops of jute and paddy with bud-stage harvest of jute (first crop) and paddy (second crop).

TABLE XXV

C. capularis (D 154 (late) and Fanduk (early).
Layout—Replicated randomized blocks in 4 replications,
Effective plot size—0·00514 acre.
Date of sowing Jute 29-3-50.
Dates of harvesting (jute): Fanduk—14-7-50, 30-7-50, 10-8-50, 28-8-50 (Control)
D154 —30-7-50, 19-8-59, 8-9-50 and 20-9-50 (Control)
Dates of transplanting paddy—8-7-50 (Control), 15-7-50, 31-7-50, 11-8-50, 28-8-50 and 9-9-50.

Treatment 1st crop jute.	Jute as 1st crop yield per acre in maunds.	Paddy as 2nd crop yield per acre in maunds.	Value of produce per acre		Total value of produce per treatment per acre.
			Jute @ Rs. 50 per md.	Paddy @ Rs. 10 per md.	
			Rs.	Rs.	Rs.
A	16·4	21·4	828	214	1,042
B	21·8	16·6	1,090	166	1,256
C	22·4	6·9	1,120	69	1,189
D	23·1	...	1,155	...	1,155
E	12·6	29·0	630	290	920
F	16·8	27·6	840	276	1,116
G	16·6	26·2	830	262	1,092
H	19·8	...	890	...	990
I	...	34·5	...	345	345

Treatments:
A (D 151) ... Harvest at pre-bud stage on 30-7-50.
B (D 154) ... Harvest at bud stage on 19-8-50.
C (D 154) ... Harvest at flower stage on 8-9-50.
D ... D 154 alone, harvest at pod stage on 20-9-50.
E (Fanduk) ... Harvest at pre-bud stage on 14-7-50,
F (Fanduk) ... Harvest at bud stage on 30-7-50.
G (Fanduk) ... Harvest at flower stage on 10-8-50.
H ... Fanduk alone, harvest at pod stage on 28-8-50.
I ... Paddy alone.

5. Date of sowing in jute.—

To study the effects of dates of sowing under Chinsurah conditions on plant growth, flowering, yield and incidence of diseases and pests, two experiments—one with *capsularis* and the other with *olitorius* jute were conducted. The treatments included eight dates of sowing in case of *capsularis* and six dates of sowing with *olitorius* at intervals of 20 days commencing from 15th February, 1950 and 1st April, 1950 respectively. Harvests were done at the usual pod stage.

From the results obtained it can be concluded that in *capsularis* the sowing period can be extended with early variety *capsularis* jute (Fanduk), whereas this period is very limited with *capsularis* late variety (D 154). March sowings are best for late variety jute D 154 but early Fanduk can be sown profitably upto 1st week of May.

Earlier sowings, however, required irrigation. In *olitorius*, the early sowings in April had to be irrigated without which neither germination nor proper crop growth was possible. The earlier sowings gave better results. These data confirm the results obtained last year that sowings later than middle of May do not grow well and prove uneconomical.

6. Intercultural experiments.—

To study the effects on yield, quality and cost of production of different frequency and number of times of intercultural operations in jute, 4 experiments—two with *capsularis* (D154) and two with *olitorius* (C.G.) both as broadcast and line grown crops were conducted in replicated randomized block layout.

Abnormal and continuous heavy rains specially at the earliest stage interfered very much with proper and timely intercultaral operations. This resulted in very much stunted growth and the experiments had to be abandoned.

VI. Soil and Biochemical Studies.

The work in the Chemistry Section during the year under review suffered considerably for the failure of gas plant and difficulties of water supply as also due to the shortage of staff. The Assistant Chemist joined on 31st July 1950. The Microbiological Assistant took long leave from 2nd August 1950 and later resigned.

Retting of Jute.—

The work on Retting was principally done with a view to shorten the retting period. Attempt was also made for the isolation of specific bacteria and other organisms responsible for the retting process.

A. *Effect of Various Substances on Retting*:—For shortening the period of retting, seven different experiments were carried out with different treatments. In each experiments various substances, meant for enhancing the growth of the microbiological population, were used. In Table XXVI the effect of different substances on retting period is shown.

The experiment could be started only late in the season. The first set of experiments which were started on 9th November 1950 had to be carried out with jute stems which were almost dry. The second set was started on 2nd December 1950 with dried jute plants after the collection of seeds and the 3rd set was started on 2nd January 51 with short and stunted green plants sown in the early winter.

TABLE XXVI.

Effect of Different Substances on duration of retting.

No. of experiment.	Treatment	No. of replications.	Date of steeping	Date of completion of retting	Average No. of days required for retting.	Percent on control.
1	2	3	4	5	6	7
I.	Steeped in 0.1% Ammonium Sulphate in Tap water	4	9.11.50	27.11.50	19	36
	Steeped in 0.1% Calcium Carbonate in Tap water	4	9.11.50	27.11.50	19	36
	Soaked in 0.5% Ammonium Sulphate in water for 24 hours and steeped in Tap water	4	9.11.50	4.12.50	26	49
	Steeped in 0.1% Tribasic potassium phosphate in Tap water	4	9.11.50	4.12.50	26	49
	Soaked in 0.5% Tribasic potassium phosphate in Tap water for 24 hours and steeped in Tap water	4	9.11.50	4.12.50 to 6.12.50	27	51

TABLE XXVI—*Contd.*

No. of experiment.	Treatment	No. of replications.	Date of steeping	Date of completion of retting	Average No. of days required for retting.	Percent on control.
1	2	3	4	5	6	7
I.	Soaked in 0.5% Calcium nitrate and in water for 24 hours and steeped in Tap water	4	9.11.50	4.12.50 to 6.12.50	27	51
	Steeped in 0.1% Calcium nitrate in Tap water	4	9.11.50	31.12.50	53	100
	Control (only Tap water)	4	9.11.50	31.12.50	53	100
II.	Soaked in 0.5% Calcium nitrate and in 0.5% Tribasic potassium phosphate in order in each for 24 hours steeped in Tap water with 1 gm. Calcium Carbonate in 500 cc.	4	99.11.50	23.11.50	14	67
	Soaked in 0.5% Tribasic potassium phosphate and in 0.5% Calcium nitrate in order in each for 24 hours steeped in Tap water with 1 gm. Calcium Carbonate in 500 cc.	4	9.11.50	25.11.50	16	76
	Soaked in 0.5% Tribasic potassium phosphate and in 0.5% Calcium nitrate in order in each for 24 hours	4	9.11.50	27.11.50	18	86

	Soaked in 0.5% Tribasic potassium phosphate and in 0.5% Ammonium sulphate in order in each for 24 hours ...	4.	9.11.50	27.11.50	18	86
	Soaked in 0.5% Calcium nitrate and in 0.5% tribasic potassium phosphate in order in each for 24 hours ...	4.	9.11.50	30.11.50	21	100
	Soaked in 0.5% tribasic potassium phosphate and in 0.5% ammonium sulphate in order in each for 24 hours steeped with 1 gm. Calcium in 500 cc. of Tap water	4.	9.11.50	30.11.50	21	100
	Soaked in 0.5% ammonium sulphate and in 0.5% tribasic potassium phosphate in order in each for 24 hours ...	4.	9.11.50	30.11.50	21	100
	Control (steeped in only Tap water) ...	4.	9.11.50	30.11.50	21	100
	Soaked in 0.5% Ammonium Sulphate and in 0.5% tribasic potassium in order in each for 24 hours and steeped with 1 gm. Calcium carbonate in 500 cc. of Tap water	4	9.11.50	30.11.50	25	119
III.	Steeped with 1 gm. Bone dust in 250 c.c. Tap water. ...	4	9.11.50	25.11.50	16	34
	Steeped in 0.1% Ammonium sulphate with 1 gm. Bone dust in 250 c.c. Tap water.	4	9.11.50	25.11.50	16	34
	Control in Tap water	4	9.11.50	31.12.50	47	100

TABLE XXVI—*contd.*

No. of experiment.	Treatment	No. of replications.	Date of steeping	Date of completion of retting	Average No. of days required for retting.	Percent on control.
1	2	3	4	5	6	7
IV. (Water from River Hooghly used as medium.)	Packed loosely with straw and retted with Bone dust	3	2.12.50	12.12.50	10	35
	Soaked in 2% Ammonium Sulphate solution for 24 hours and steeped with Bone dust	3	2.12.50	12.12.50	10	35
	Packed loosely with straw after soaking with 2% ammonium sulphate solution for 24 hours and steeped with bone dust	3	2.12.50	12.12.50	10	35
	Steeped with Bone dust	3	2.12.50	18.12.50	16	55
	Packed loosely with straw	3	2.12.50	31.12.50	29	100
	Soaked in 2% potassium nitrate for 24 hours and steeped with Bone dust ...	3	2.12.50	31.12.50	29	100
	Packed loossly with straw after soaking with 2% potassium nitrate for 24 hours and steeped with bone dust ...	3	2.12.50	31.12.50	29	100

	Soaked in Ammonia water for 24 hours and steeped with bone dust ...	3	2.12.50	31.12.50	29	100
	Packed loossly with straw after soaking with ammonia water for 24 hours and steeped with Bone dust	3	2.12.50	31.12.50	29	100
	Control.	3	2.12.50	31.12.50	29	100
V. (Tap water used as medium).	Steeped with Bone dust.	3	2.12.50	18.12.50	16	55
	Soaked with 2% ammonium sulphate for 24 hours and steeped with Bone dust ...	3	2.12.50	18.12.50	16	55
	Soaked with 2% potassium nitrate for 24 hours and steeped with Bone dust ...	3	2.12.50	18.12.50	16	55
	Soaked with Ammonia water for 24 hours and steeped with Bone dust ...	3	2.12.50	31.12.50	29	100
	Loosely packed with straw	3	2.12.50	31.12.50	29	100
	Control	3	2.12.50	31.12.50	29	100
VI. (Retting water obtained from Chinsurah Farm used as medium).	Steeped with Bone dust	4	2.12.50	12.12.50	10	35
	Soaked in 2% ammonium sulphate solution for 24 hours, steeped with Bone dust	4	2.12.50	12.12.50	10	35

TABLE XXVI—*contd.*

No. of experiment.	Treatment	No. of replications.	Date of steeping	Date of completion of retting	Average No. of days required for retting.	Percent on control.
1	2	3	4	5	6	7
VI.	Soaked in 2% potassium nitrate solution for 24 hours and steeped with Bone dust	4	2.12.50	31.12.50	29	100
	Loosely packed with straw after soaking with ammonia water for 24 hours and steeped with bone dust...	4	2.12.50	31.12.50	29	100
	Loosely packed with straw and steeped with Bone dust ...	4	2.12.50	31.12.50	29	100
	Loosely packed with straw	4	2.12.50	31.12.50	29	100
	Control	4	2.12.50	31.12.50	29	100
VII.	Steeped with 5 gms. Bone dust in 0.1% ammonium sulphate solution in Tap water containing 0.01 p.p.m. of sodium solenate (added). ...	2	2.1.51	16.1.51	14	53
	Steeped with 5 gms. Bone dust in 1 litre Tap water	2	2.1.51	18.1.51	16	61
	Steeped in 0.1% Ammonium sulphate solution in Tap water	2	2.1.51	28.1.51	26	100
	Control in Tap water	2	2.1.51	28.1.51	26	100

From the data presented in Table XXVI, it may be seen that bone dust has lowered the duration of retting in all cases to the maximum of 30% or so of control. The effect of this substance singly and in combination and to fix up the optimum dose of bone dust when used alone or in combination with other chemicals under different conditions will be taken up in 1951-52 season.

The pH was found to rise during retting after an initial fall and this condition was also observed at our Dacca Laboratories in the past. Soaking jute sticks with ammonia water to give an initial rise of pH, however, had no effect in reducing the period of retting. $CaCO_3$ has been found to lower the duration of retting to 36% of control. Ammonium sulphate was also found to be effective. The causes for lowering of retting duration will be investigated in future.

The retting water after the completion of retting was analysed for total as well as organic and inorganic phosphorus compounds present in the soluble form. Soluble calcium and methyl red alkalinity were also estimated. The estimation of nitrate-nitrogen, ammonium-nitrogen and total nitrogen of retting water could not be carried out as the Gas Plant failed to work when samples for analyses were ready. On the result of the first year's work, though encouraging no definite conclusion however can be made without further trial, more so, as the experiment was carried out in off-season.

B. *Microbiological studies.*—The work on isolation of organisms responsible for retting was started afresh as the cultures of the previous years were damaged due to causes beyond our control.

Work on Soils

Double and triple cropping experiment.—This work was carried out, in collaboration with the Agronomy Section, to study the amount of exhaustion of soils in double and triple cropped lands. Samples were received from double cropping and triple cropping plots before jute, after jute, after paddy and after pulse. The samples after pulse were rececived too

late to be analysed in the period under review. In these samples, total N, organic matter (by wet combustion), exchangeable Ca and K (in two consecutive extracts with seminormal acetic acid extract using a soil; solution ratio 1 : 50 for each extract), easily available P(using the same extractant in two consecutive extracts) were determined. In case of certain selected treatments total exchangeable bases were also determined. The results, so far obtained, indicated that the soil is not appreciably exhausted by cropping with jute, under Chinsurah conditions. The work will be continued.

Manurial trials.—To study effects of exhaustion of the soil by cropping with jute under various manurial treatments of soil, soil samples were obtained before and after jute from the manurial trials of the Agronomy Section for analyses. The work is in progress.

In connection with diseases—From disease point of view 11 samples were analysed for informations as required.

Samples from highly affected, partially affected, slightly affected and not affected areas in Tarakeswar were analysed for exchangeable Ca, K (by William's method), organic matter by Walkley and Black's method), pH (colorimetrically) and easily available P (by acetic acid extract method). Lime requirement and other relevent works are in progress.

Analysis of plants—Analysis of plant material obtained from manurial trial plots were begun as an aid to develop diagnostic techniques. A portion of the stem measuring 20 cm from the top was cut and leaves from that portion were separated. Leaves and stems were analysed separately for inorganic K, Ca and P at pre-bud and bud stages. At harvest stage, in addition to the first 20 cm portion from the top, another 20 cm portion of the stem immediately below that were also analysed. Materials for total analysis for all these stages were prepared but could not be done for shortage of staff and other difficulties.

Miscellaneous.—Informations about several soils and fertilisers were supplied as and when required after analysis.

VII. DISEASES.

1. Study of the Effects of Environmental Factors on Secondary Infection due to Macrophomina Phaseoli.

Data obtained from the 'Date of sowing experiment' confirm the results obtained in the year 1949-50. It has been found that throughout the jute season the humidity seldom fell below 80 percent. During the moth of June, July and August the humidity mostly ranged between 95 and 100 percent. The maximum temperature during the same period ranged between 85 and 95°F. Leaf infection was heaviest during the critical days of high humidity and temperature. On such susceptible days, if the inoculum is present, infection is restricted to younger plants; it will be seen from Table XXVII that on 5th July 1950 infection was restricted only in plants sown in May, June and July. Of those again the crop sown in the first week of May had the least infection.

Field observations show that spread of leaf infection is always preceded by moderate showers. It would be seen that under Chinsurah conditions, earlier sowings proved better in respect to diseases.. Sowings later than middle of May does not seem to be profitable from the point of view of disease.

TABLE XXVII.

Showing stem-rot at different dates and the mean stem-rot percent for each sowing date.

Dates of sowing.	Stem-rot percent from six replications.												Mean Stem-rot %	
	2-5-50		2-6-50		21-6-50		4-7-50		1-8-50		5-9-50			
	D 154	Fanduk	D 154	Fanduk	D 154	Fanduk	D 154	Fanduk	D 154	Fanduk	D 154	Fanduk	D 154	Fanduk
15th Feb ...	11·2	7·7	0·0	0·0	35·3	17·8	...	...	...	...	...	...	15·5	8·5
7th March ...	9·9	3·5	0·0	0·0	8·7	4·1	18·7	11 3	13·0	...	...	...	10·0	4·7
27th March ...	15·1	10·5	2·4	2·2	4·7	3·8	6·0	12·1	6·6	12.2	...	...	6·9	8·2
16th April ...	4·0	3·7	3·4	0·7	10·4	4·4	7·6	10·6	6·4	7·9	...	...	6·3	5·5
6th May ...	...	...	11·4	10'8	13·4	13·6	27·1	13·3	2·4	9·1	7·6	6·1	12·7	10·6
26th May ...	...	...	...	...	95·7	54·2	125·8	102·3	106·8	63·7	31·6	16·8	89·9	59·3
15th June ...	...	...	...	...	...	...	3·3	2·2	16·8	11·9	73·4	28·8	31·1	14·3
5thJuly ...	...	...	...	...	...	...	...	...	12·7	10·3	84·7	53·1	48·7	31·7

2. STUDY OF THE STEM ROT FUNGUS :

(*i*) *Inoculation experiments with Macrophomina phaseoli.*— It was reported previously that inoculation of soil with sclerotia produced in artificial cultures failed to induce infection in the plants selected for stem rot resistance. Investigations were carried to determine the conditions necessary for inducing artificial infection under field conditions. The details are shown in Table XXVIII.

TABLE XXVIII.

Treatment.	1st. Set					2nd. Set			
	Inoculum.	Number of seed sown	No. emerged.	Pre Emergence deaths	Post Emergence infection	No. sown.	No. emerged.	Pre Emergence death	Post Emergence infection.
Field soil, sterilized plus Ammonium sulphate @ 60 lb. N per acre ...	+	20	2	18	2	20	4	16	0
Field soil, sterilized plus Ammonium sulphate @ 30 lb. N per acre ...	+	20	6	14	3	20	15	5	1
Field soil, sterilized ...	+	20	18	2	...	20	19	1	0
Field soil, sterilized ...	–	20	20	0	...	20	20	0	0
Field soil, unsterilized plus Ammonium sulphate @ 60 lb. N per acre	+	20	8	2	2	20	16	4	1
Field soil, unsterilized plus Ammoniun sulphate @ 30 lb. N per acre	+	20	11	9	3	20	17	3	2
Field soil, unsterilized ...	–	20	15	5	3	20	17	3	3

The soil was collected from Chinsurah fields where stem-rot infection occurred in earlier years (1949). Pieces of jute stubbles bearing sclerotia collected in 1950 were used as inoculum.

It was found that field stubbles could initiate infection in sterilized field soil. Infection also occurred in unsterilized

field-soils, indicating presence of the fungus. Mortality, however, increased with the addition of ammonium sulphate @ 30 lbs. N per acre and more so with double that dose. Pre-emergence mortality was higher than post emergence infection; the seedlings on examination showed the presence of hypha and sclerotia in most of the cases. Mortality was higher in sterilized soil, probably due to the fact that unsterilized soil retained micro-organisms which had antagonistic properties against *Macrophomina phaseoli*.

From the above results it may be said that an epidemic of stem-rot can be induced artificially in the field; this will facilitate the work of selection for stem-rot resistance.

The results also reveal that from disease point of view application of Ammonium sulphate as manure likely to cause less damage if used as top-dressing.

(*ii*) *Study of the cultural characteristics.*—Studies on the effects of different salts on the growth of *Macrophomina phaseoli* grown on synthetic medium were taken up. Richard's synthetic agar was used in these studies. Elimination of nitrates from the medium retarded growth of the mycelim; production of sclerotia was delayed and the number of sclerotia was much less as compared to that produced in the full medium. Absence of potash affected the colour and shape of sclerotia which were pale brown, loose and irregular in contour. Growth of mycelium in this case was not so much retarded as by absence of nitrates.

3. Nature and Causes of Chlorosis.

The study of the nature and causes of chlorosis was continued. Seeds were collected in 1949 from 19 chlorotic *C. capsularis* and 2 *C. olitorius* selections. The entire quantity of seeds were sown in 21 plots. The performance of the progenies are shown in the following table.

TABLE XXIX.

Selection.	No. of seed sown	No. germinated	Percent germinated	No. of chlorotic plants	Per cent chlorotic plants
A	1407	269	19.1	1	0.4
B	519	13	2.5	0	0.0
C	856	207	24.2	9	4.3
*D	3829	199	5.2	5	2.5
E	356	131	36.8	11	8.4
*F	8000	2035	25.4	1	0.04
G	1434	381	26.6	5	1.3
H	1909	922	48.3	27	2.9
I	2404	584	24.3	59	10.0
J	776	123	15.9	16	13.0
K	1711	230	13.4	31	13.5
L	827	88	10.6	18	20.4
M	163	25	15.3	3	12.0
N	3599	642	17.8	11	1.7
O	2064	512	24.8	13	2.5
P	847	126	14.9	29	23.0
Q	1517	419	27.6	7	1.7
R	447	141	31.5	24	17.0
S	538	242	45.0	19	7.9
T	1370	294	21.5	19	6.5
U	187	15	8.0	7	46.7

**C. olitorius.*

It has been already stated in the previous report that in a normal cropped area (*i.e.* in a bulk population) the ratio of chlorotic plants is 1 in 3000 in *C. capsularis* and is 1 in 5000 in *C. olitorius*. But in case of single chloritic plant selections the ratio was 195 in 2478 in 1949-50 and 225 in 7598 in 1950-51. As the number of chlorotic plants once observed in the early stages in a given area, does not increase significantly, it is assumed that transmission by insects does not take place. Very rarely this number increases; that increase is explained by the fact that some plants apparently healthy have latent infection which reveal the symptoms afterwards. Presence of a good number of chlorotic individuals in the progeny of a single plant selection, however, indicates transmission through seed.

To determine the role of pollen in transmission, pollen from chloritic plants were transferred to stigma of non-chlorotic

individuals. Such crosses were mostly unsuccessful and only 3 pods were obtained. The progeny test will be made in 1951-52.

Induction of chlorosis by grafting had been successful. Of the 16 successful grafts 6 were with non-chlorotic scion and chlorotic stock, 10 were with chlorotic scion and non-chlorotic stock.

Nature of graft		Nmber of successful grafts.	Number of grafts where transmission was effected.	Number of grafts where induction failed or symptoms disappeared.
Stock	Scion			
Chlorotic.	Non-chlorotic.	6	4	2
Non-chlorotic.	Chlorotic.	10	1	9

Out of 10 chlorotic scions 9 failed to induce chlorosis or the symptoms disappeared completely, while positive transmission was effected in 1 only. Out of 6 chlorotic stock complete disappearance of symptoms was observed in 2 and the remaining 4 induced chlorosis in the non-chlorotic scion and the symptoms were evident after 18 days.

4. Control Measures.

(*i*) *Selection of stem-rot resistant types.*—59 selections from improved strains of *capsularis* evolved by the Institute, 21 selections from the improved *olitorius* types and 52 selections from heterozgous *capsularis* material were tried in a replicated randomized layout. Care was taken to induce artificial infections by application of pycnospores and sclerotia bearing stubbles. Records of pigmentation, morphological characteristics and disease were taken. The crop, however, remained almost disease free, except for a few cases of collar rot and stem rot. All the cultures were brought forward for further study in 1951-52.

Observation recorded (records were kept according to Horsfall's method) in *Capsularis* varietal trial No. 1, where natural inoculum for root rot and soft rot was uniformly distributed, showed that C 41-13, C39-212, Fanduk, D154 and Deshimara had 1-3 per cent stem-rot infection. C42-321 had 3-6 per cent, Orissa 6 had 6-12 per cent and Jap Red had 50-75 per cent infection. Jap Red was distinctly susceptible and the death rate in this type was high.

Seed treatment and storage.—Seeds stored for different lengths of time, including treated and untreated ones, were sown in randomized replicated plots for the comparative study of their yields. There was good germination in all the plots; but due to late sowing field operations could not be given in time. Hence the crop was not harvested. It was, however, found that for two years old seeds viability depended more on the condition of storage and not so much on age and indications are that old seeds will give as good a crop as fresh seeds, provided both are stored properly.

Application of fertilizer to check incidence of disease.—Manurial trials conducted by the Agronomy section (described in earlier pages) were generally disease free. Hence records did not give any significant results.

Chemical sprays to control leaf infection.—No regular trial was conducted. But spraying measures taken in different infected field showed that 1 per cent perenox was effective in checking leaf infection in 3 weeks old crop of *C. capsularis.* When the strength of perenox raised to 2 percent there was no scorching effect and it was more effective in checking leaf infection. Leaves bearing pycnidia were collected after spray. Examination and germination test of the pycnospores showed that there was cent per cent kill.

VIII PESTS

During the period under report, *Anomis sabulifera* was wide spread. The pest was put under check in the Farm by application of suitable insecticides. Incidences of other pests

were comparatively negligible except for *Nupserha bicolor* subsp. *postbrunnea* Bruen (reported earlier as Cyrambycid borer—to be identified). Frequency of incidence of this pest has been on the increase since it was first recorded in 1949-50. The pest may prove in the long run to be one of the major pests of *olitorius* jute.

Relative resistance of improved capsularis types against Apion corchori—Records on the extent and intensity of *Apion* damage were taken in 14 different improved strains in the two *capsularis* varietal trial expeirments at two stages of growth, *viz.* 7th week stage and 16th week stage. C42-Kj-321 proved to be more resistant for *Apion* damage in comparison to other strains.

Relative resistance of improved olitorius types against Apion corchori.—No significant differences on resistance to *Apion corchori* was observed in the *olitorius* varieties.

Selection for resistance against Apion corchori.—Selections from different improved *capsularis* types were put in first year's trial with four replications. One selection made from C42-Kj-321, has performed best amongst 60 cultures. Of the 21 *olitorius* cultures, no significant difference was obtained. Promising cultures have been brought forward for next year's trial.

Susceptible spot for Apion oviposition.—For determination of susceptible spot for *Apion* oviposition, one branched type (D154) and one non-branched type (Halmehera) were examined. Altogether 4719 ovipositions in 2000 affected plants selected at random were examined. It is evident from Table XXX that nodal joint just below the leaf-base and sides of the leaf base are the susceptible spots in the stem for *Apion* oviposition both in branched and non-branched types. In branched type (D154) axillary buds are also favourable spots for oviposition.

TABLE XXX

Frequency of Apion oviposition in different regions of the plant

Name of type	Total affected plants	Total oviposition	Frequency of oviposition						
			Internode	Petiole	Lamina	Axil or Axil bud	Opposite leaf base	Leaf base side	Below leaf base
D 154 ...	...	...	119	23	0	547	40	727	859
(Branching)	1000	2315	(5·14%)	(0·99%)	Nil	(23·63%)	(1·73%)	(31·4%)	(37·11%)
Halmehera ...	1000	2404	210	15	0	111	42	441	1585
(Non-branching) ...		...	(8·74%)	(0·62%)	Nil	(4·62%)	(1·75%)	(18·34%)	(65·93%)

Effect of damage by major pests on fibre yield.—The trial failed due to water logging.

Effect of different dates of sowing on the incidences of major pests of jute.—Sowings in the two dates of sowing traials, one with *capsularis*—early (Fanduk) and late (D154) and the other with *olitorius* (C.G.) were done at intervals of 20 days, starting from the 15th February for *capsularis* trial and 1st April for *olitorius* trial.

Periodical observations were recorded as in the previous year from the crops sown on different dates on the extent of incidences by *Laphygma exigua*, *Apion corchori*, *Anomis sabulifera* and *Hemitarsonemus latus*.

Results on the incidence of *Laphygma exigua* (Table XXXI and XXXII) corroborated the previous year's observations. It is evident from the data in Tables XXXI and XXXII below that early sown crop becomes more liable to the damage by *Laphygma exigua* irrespective of varieties.

TABLE XXXI

Effect of different times of sowing on the extent of attack by *L. exigua* in mean% *Capsularis* (D154 and Fanduk)

Treatmets. (Dates of sowing)	D154 (late variety)			Fanduk (early variety)		
	1 month old crop	2 months old crop	3 months old crop	1 month old crop	2 months old crop	3 months old crop
A. 15-2-50	0·00	4 28	0·00	0·00	13·41	0·00
B. 7-3-50	7·21	7·91	0·00	7·44	3·58	0·00
C. 27-3-50	7·27	0·00	0·00	6·29	0·00	0·00
D. 16-4-50	18·76	0·00	0·00	16·68	0·00	0·00
E. 6-5-50	0·82	0·00	0·00	2·43	0·00	0·00
F. 23-5-50	0·00	0·00	0·00	0·00	0·00	0·00
G. 15-6-50	0·05	0·00	0·00	0·06	0·00	0·00
H. 5-7-50	0·00	0·00	0·00	0·05	0·00	0·00
C. D. ...	7·24	4·59	...	6·92	8·13	...

TABLE XXXII.

Effect of different times of sowing on the extent of attack by *L. exigua* in mean % *Olitorius* (C. G.)

Treatments (Dates of sowing)	1 month old crop	2 months old crop	3 months old crop
A. 1-4-50	5·45	0·00	0·00
B. 21-4-50	0·00	0·00	0·00
C. 11-5-50	0·00	0·00	0·00
D. 31-5-50	0·00	0·00	0·00
E. 20-6-50	0·00	0·00	0·00
F. 10-7-50	0·17	0·00	0·00
C. D.	2·60	...	...

Records on the incidence of *Apion corchori* (Tables XXXIII and XXXIV) for this season also supported the observations made in the previous year. Crops sown late became less liable for damage by *Apion Corchori*. It is also evident from the Tables that the month of June is the peak oviposition period.

TABLE XXXIII.

Effect of different times of sowing on the extent of attack by *Apion corchori* in mean % *Capsularis* (D154 & Fanduk)

Treatments (Dates of sowing)	D154				Fanduk			
	1-30 days.	31-60 days.	61-90 days.	91-120 days.	1-30 days.	31-60 days.	61-90 days.	91-120 days.
A. 15-2-50	0·00	5·15	34·72	50·65	0·00	5·03	60·87	27·96
B. 7-3 50	7·64	7·55	32·50	50·20	0·56	17·73	31-27	44·02
C. 27-3-50	2·15	20·82	62·49	8·07	1·06	24·50	63·66	2·08
D. 16-4-50	1·96	61·15	16·97	7·87	2·20	64·01	13·30	8·15
E. 6-5-50	22·65	9·72	35·70	0·45	32·28	5·17	33·92	0·33
F. 26-5-50	17·30	3·28	5·26	17·43	27·99	2·70	11·87	12·81
G. 16-6-50	1·03	4·72	8·10	7·96	0·68	5·93	7·80	5·48
H. 5-7-50	1·05	2·02	3·56	...	1·69	1·76	3·63	...
C. D.	8·17	12·39	16·88	15·67	14·85	15·38	23·93	21·21

TABLE XXXIV.

Effect of different times of sowing on the extent of attack by *Apion corchori* in mean % *Olitorius* (C. G.)

Treatments (Dates of sowing)	1-30 days.	31-60 days.	61-90 days.	91-120 days.
A. 1-4-50	1·72	19·90	66 29	11·26
B. 21-4-50	2·72	51·20	25·00	12·93
C. 11-5-50	14·90	36·72	15·86	...
D. 31-5-50	4·25	4·99	2·20	30·10
E. 20-6-50	1·97	2·50	30·80	1·87
F. 10-7-50	1·27	7·94	8·92	...
C. D.	3·20	15·58	14·56	16·7 1

Liability of crops to damages of *Anomis sabulifera* (Tables XXXV and XXXVI) increases when the sowing was delayed; while early sowings caused increased incidences of attack by *Hemitarsonemus latus* (Tables XXXVII and XXXVIII). Observations with respect to the incidences of these pests corroborated last year's record.

TABLE XXXV

Effect of different times of sowing on the extent of attack by *Anomis sabulifera* in mean % *Capsularis* (D154 & Fanduk)

Treatments (Dates of sowing)	D 154				Fanduk			
	1 month old crop	2 months old crop	3 months old crop	4 months old crop	1 month old crop	2 months old crop	3 months old crop	4 months old crop
A. 15-2-50	0·00	0·00	6·20	0·00	0·00	0·00	35·61	0·00
B. 7-3-50	0·00	0·00	0·00	11·30	0·00	0·00	0·00	12·68
C. 27-3-50	0·00	2·42	7·20	17·24	0·00	2·30	10·27	20·67
D. 16-4-50	0·07	0·00	17·62	13·56	0·16	0·00	22·14	10·60
E. 6-5-50	0·00	14·33	38·65	19·27	0·00	19·64	41·87	9·23
F. 26-5-50	0·28	16·73	20·64	00·0	0·00	11·19	20·37	0·00
G. 16-6-50	0·00	4·50	2·10	3·10	0·00	5·82	1·45	3·06
H. 5-7-50	0·32	5·68	2·66	...	1·60	6·67	2·21	...
C. D.	...	5·93	13·12	15·74	1·08	6·95	27·56	7·35

TABLE XXXVI

Effect of different times of sowing on the extent of attack by *Anomis sabulifera* in mean % *Olitorius* (C. G.)

Treatments (Dates of sowing)	1 month old crop	2 months old crop	3 months old crop	4 months old crop
A. 1-4-50	0·00	0·00	2·18	22·93
B. 21-4-50	0·00	5·44	18·89	13·83
C. 11-5-50	0·00	11·69	8·71	—
D. 31-5-50	0·00	25·03	27·63	0·00
E. 20-6-50	5·82	7·17	2·65	1·29
F. 10-7-50	0·44	7·79	10·82	—
C. D.	3·53	12·25	—	11·29

TABLE XXXVII

Effect of different times of sowing on the extent of attack by *H. latus* in mean %

Capsularis (D154 & Fanduk)

Treatments (Dates of sowing)	D 154				Fanduk			
	1 month old crop	2 months old crop	3 months old crop	4 months old crop	1 month old crop	2 months old crop	3 months old crop	4 months old crop
A. 15-2-50 ...	0·00	0·00	1·06	4·07	0·00	0·00	0·76	25·93
B. 7-3-50 ...	0·00	0·00	33·85	29·15	0·00	0·00	47·61	25·12
C. 27-3-50 ...	0·00	4·33	11·85	44·80	0·00	1·83	12·05	44·60
D. 16-4-50 ...	0·00	0·00	41·07	15·03	0·00	0·00	32·77	17·27
E. 6-5-50 ...	0·00	0·37	36·01	9·89	0·00	0·71	34·52	13·94
F. 26-5-50 ...	0·00	15·13	8·37	0·00	0·00	17·96	11·57	0·00
G. 15-6-50 ...	0·00	6·15	1 44	0·00	0·00	4·91	1·74	0·00
H. 5-7-50 ...	0·00	1·30	0·00	...	0·00	1·13	0·00	...
C. D.	...	3·24	11·49	13·07	...	5·30	21·22	28·98

TABLE XXXVIII

Effect of different times of sowing on the extent of attack by *H. latus* in mean %

Olitorius (C. G.)

Treatments (Dates of sowing).	1 month old crop.	2 months old crop.	3 months old crop	4 months old crop.
A. 1-4-50 ...	0 00	50·17	29·47	47·59
B. 21-4-50 ...	28·48	11·03	36·11	19·71
C. 11-5-50 ...	3·28	44·65	25·00	...
D. 31-5-50 ...	1·98	49·05	2·97	0·00
E. 20-6-50 ...	5·51	11·04	3·47	0·00
F. 10-7-50 ...	2·94	2·81	5·07	...
C. D. ...	18·56	21·60	11·37	19·97

Nupserha bicolor Thomps. sub sp. postbrunnea Bruen.

The Cyrambycid borer, reported earlier, has, since been identified as *N. bicolor* sub sp. *postbrunnea*. Incidence of this pest in *olitorius* types of jute has increased so much so as to necessitate the study of the pest from different aspects.

The pests were multiplied and bred in the laboratory. Observation shows that the process of oviposition is directly responsible for damage done. Preliminary observation in the laboratory shows that total oviposition period extends about a month during which about 60 ova are laid. Ova are almost always laid singly within the pith region of the stem. Each ovum measures about 1.8 mm in length, 0.5 mm in breadth. Eggs are slightly curved at the middle and gradually tapers at the anterior end. Incubation period of egg has been found to vary from 3 to 4 days. It was observed that mandibles play an important part during the process of oviposition. Mandibles make two rings and pierce the stem-tissues to the desired depth wherein egg is laid. Mandibles seem to determine selections of spot in the stem for oviposition. The correlation between the mandibular length and the stem diameter of the susceptible region for oviposition on the host is under study. Susceptible stem diameter of the host has been found to vary from 0.2 cm to 0.4 cm, irrespective of age.

Under laboratory condition the pests have been found to hibernate as grub within the dry twigs of the host or under the soil. The total period of hibernation is under observation.

Feeding habits of the adults are entirely different from other recorded pests of jute. Adults feed upon the vascular bundles of leaves leaving aside the flat surface. They also feed upon the apical region of stem in longitudinal streaks.

Further study on the biology of the pest is in progress.

Alternate hosts.—The following have been recorded as alternate host plants for *N. bicolor* subsp. *postbrunnea*: (*i*) *Crotalaria juncea*, (*ii*) *Crotalaria saltiana* var *striata*, (*iii*) *Hibiscus cannabinus*, (*iv*) *Aeschynomene aspera*, (*v*) *Sesbania aegyptica* var *picta*.

THE PEST & DISEASE CONTROL SCHEME, TARAKESWAR

200 acres of cultivators' land was brought under the scope of control measures and study. Of these 84 acres were ploughed down by the cultivators themselves because of crop failures.

The soil in the area is sandy loan and its water holding capacity is very poor. Death due to drought at early stages is common. Deep mulching of the soil during weeding operation is avoided and a larger stand than usual is maintained. Jute and potato are universally cultivated in the same plots in succession.

A plot to plot survey has been completed and a history of the plots has been prepared. The survey reveals that insect damage specially by Jute semi-looper is well-known for years; but cultivators could not distinguish between different types of insect damages; hence the status of other pests are not clear from their statements.

Root-rot, collar-rot and stem-rot, specially the former two are known to be perpetual cause of crop failure in certain plots. Nearly 60 acres suffered from root-rot. *Macrophomina phaseoli*, *Sclerotium rolfsii* and *Fusarium* sp. have been repeatedly obtained in culture from diseased roots and stems. *Fusarium* was not known to cause epidemic root-rot or damping off in jute; hence it is still to be proved by inoculation tests whether the *Fusarium* found in Tarakeswar jute fields are primary parasites or not.

Stem-rot leading from secondary leaf infection though present is less known.

Anomis sabulifera was very wide spread and caused maximum amount of damage. *Hemitarsonemus latus*, *Laphygma exigua*, *Apion corchori* also appeared during the season but did little damage.

These pests, particularly *Anomis sabulifera*, were kept under check by application of suitable insecticides such as water-base DDT, Gammexane, Hexyclan, Calcium arsenate, Lead arsenate and Lime-sulphur. Of the various insecticides used under field conditions for the control of *Anomis sabulifera* 0.5—0.75% water-base DDT proved best with a capacity to withstand light shower.

Data collected from Tarakeswar Station corroborated result of the 'Dates of Sowing Experiment' conducted at the Institute's farm at Chinsurah. According to this experimental result, jute crop becomes more liable to damage by Anomis *sabulifera* if sowing is done beyond 1st week of May upto 1st week of June. Range of sowing time at Tarakeswar was was 11.5.50 to 6.6.50 and as expectation (according to the experimental result) incidences of *Anomis sabulifera* were much more in comparison than others as is evident from the Table below:

TABLE XXXIX

Extent of attack in terms of precent from an area of 115 acres.

Range of sowing time at Tarakeswar.	Name of Pest	Extent of attack			
		1-3%	4-20%	21-40%	Above 40%
11-5-50 to 6-6-50 (most of the plots were sown on 11-5-50 and 14-5-50)	*A. sabulifera*	12·79	15·63	20·27	49·86
	A. corchori	27·51	6·39	1·42	0·96
	H. latus	18·25	12·18	9·98	2·26
	L. exigua	1·36	...	...	...

Certain plots were selected for the trial of recommended remedial measures against root-rot and collar-rot. This included:—(*i*) Seed treatment with Agrosan GN, (*ii*) application of lime and (*iii*) application of Muriate of potash. In three of the selected plots mortality was reduced to 12% as against 25-40% of previous years. Perenox was used against leaf infection, but leaf infection in general was low during the season.

General.—Assessment of efficacy of control measures in terms of yield was not possible largely due to cultivators' ignorance and apathy. Besides these, factors like differences in seed-rate, stand, date of sowing and manures used, may account for large differences. Hence it is more advisable to depend on actual counts of attacked plants and intensity of damage than on uncertain and inaccurate yield figures gathered from cultivators' statements. Efforts are, however, being made to get correct yield figures as far as possible.

In 1951-52, the programme of work includes:—(*i*) The study of efficacy of control measures, (*ii*) Economics of each control measure, (*iii*) Effect of damage on yield.

SUBSTITUTE FIBRES

I. Botanical and Agronomical Studies :

1. *Collection of seeds and other propagative materials.*—Seeds of various fibre crops were received from different parts of India and foreign countries (China and U.S.A.) and added to the existing collections. As the quantity of seeds in most cases was small, they were grown for seed multiplication and preliminary observations.

The collections included the following substitute fibre crops:—(1) *Hibiscus cannabinus*, (2) *H. sabdariffa*, (3) *H. esculentus*, (4) *Abutilon spp.*, (5) *Sida spp.*, (6) *Urena spp.*, (7) *Abroma augusta*, (8) *Crotalaria juncea*, (9) *Malachra capitata*, (10) *Sesbania aculeata*, (11) *Boehmeria nivea*, (12) *Linum usitatissimum*, (13) *Cannabis sativa*, (14) *Agave spp.*

2. *Study of characteristics of the fibre plants.*—Distinguishing features, growth and developmental characteristics were studied. The fibre percentage in respect of green weight has been ascertained in majority of the collections made and is shown in the following table :—

Perceantage of fibre in respect of green weight (including leaves)

1.	*Hibiscus cannabinus* (*Mesta*)	5.97%
2.	*Hibiscus sabdariffa* var *altissima* (Roselle) ...	5.6 %
3.	*Abroma augusta*	5.55%
4.	*Urena sinuata*	4.5 %
5.	*Sida rhombifolia*	3.7 %
6.	*Malachra capitata*	3.7 %
7.	*Urena lobata*	3.24%
8.	*Crotalaria juncea* (Sunn-hemp)	2.73%
9.	*Abutilon spp.*	2.26%
10.	*Sesbania aculeata*	1.45%

For work with substitute fibre crops more attention was *paid to H. cannabinus, H. sabdariffa, Linum usitatissimum* and *Crotalaria juncea.*

3. *Isolation of types.*—Selections based on various characters like yield, maturity, anthocyanin pigmentation, leaf shape, height, basal diameter, etc. were made in both *H. cannabinus* and in bristled and non-bristled types of *H. sabdariffa.* A large number of *H. cannabinus* field selections were made after a scrutiny of their P.H. and B.D. with other characters and will be put in the first stage trial next year.

4. *Hybridization.*—Inheritance of pigmentation pattern in a suspected natural hybrid of *H. sabdariffa* var *altissima* (1949-50) was studied and the following four phenotypes were identified :—(*a*) Green pigmented, (*b*) Piebold red (Light red), (*c*) Red and (*d*) Green. Some new crosses and back crosses were made between the individuals of these different phenotypic groups and the parents.

A number of fresh crosses were made amongst different anthocyanin pigmentation grades, bristled and non-bristled characters and varying leaf shapes in *H. sabdariffa.*

A number of crosses were also made amongst the six different pigmentation grades of *H. cannabinus.*

5. *Date of sowing experiment.—H. sabdariffa* var *altissima* and *H. cannabinus* were sown in alternate lines in small plots at intervals of fifteen days beginning from December

1950. The object is to study the general behaviour of the crop throughout the season and also to obtain simultaneous flowering of these two different species of *Hibiscus* for interspecific crossings. The other object is to try methods of vegetative rapprochement of the two species with a view to overcome cross incompatibility.

6. *Trial of spacing cum stages of harvest with Hibiscus cannabinus* and *H. sabdariffa* var *altissima*.—Two complex experiments on a split-plot factorial model were conducted during the year. The results are given below for *H. cannabinus* and *H. sabdariffa* var *altissima* respectively.

TABLE XL.

H. cannabinus

Layout:—Split plot design with six replications.

Effective plot size:—(a) Main plot ... 51′ × 15′
(b) Sub-plot ... 17′ × 15′

Date of sowing—19.5.50.

Dates of harvest:—(a) Bud stage—6.9.50, (b) Flower stage—20.9.50, (c) Pod stage—27.9.50.

(*a*) *Maintreatments.*	*Yield per acre in lbs.*
Spacings	
2″ × 12″	1443.30
Broadcast	1430.60
No thinning × 12″	1292.24
4″ × 12″	1276.12
6″ × 12″	1963.20
C. D.	102.42

(*b*) *Sub-treatments*	*Yield per acre in lbs.*
Stages of harvest	
Pod stage	1341.18
Flower stage	1345.93
Bud stage	1216.19
C. D.	35.59

(*c*) *Interactions*—Main treatments × Sub-treatment

(*yield per acre in lbs*)

Treatments	Bud stage	Flower stage	Pod stage	Total
Broadcast ...	1243·20	1441·50	1607·10	1430·60
No thinning × 12″	1250·82	1303·20	1322·70	1292·24
2″ × 12″ ...	1353·90	1512·60	1463·40	1443·30
4″ × 12″ ...	1234·26	1300·50	1293·60	1276·12
6″ × 12″ ...	998·70	1171·86	1019·10	1063·20
Total ...	1216·19	1345·93	1341·18	1301·10

C. D.—177·99 lb.

TABLE XLI

H. sabdariffa var *altissima*

Layout:—Split plot design with six replications.

Effective plot size:—(*a*) Main plot ... 5*l*′ × 15′

(b) Sub-plot ... 17′ × 15′

Date of sowing—23.5.50.

Dates of harvest:—(*a*) Bud stage—8.11.50, (*b*) Flower stage ——23.11.50 and (*c*) Pod stage—11.12.50

(*a*) *Main treatments.*	*Yield per acre in lbs.*
Spacing	
Broadcast	664.42
4″ × 12″	572.58
2″ × 12″	540.90
6″ × 12″	516.96
No thinning × 12″	509.30
C. D.	63.27

(*b*) *Sub-treatments*

Stages of harvest	*Yield per acre in lbs.*
Pod stage	585.88
Flower stage	555.36
Bud stage	541.26
C. D.	14.25

TABLE XLII.

Analysis of variance of fibre weights of *H. connabinus* (weight in grammes)

Variance due to	D.F.	S. S	M. S.	F.	P.
1. Blocks ...	5	5703313·2	1140662·6	...	...
2. Main treatments	4	13094511·9	3273627·9	12·3	Highly significant.+
3. Error (*a*) ...	20	5309232·9	265461·6	...	...
4. Main plots ...	29	24107058·0	...	...	...
5. Sub-treatments	2	2506574·4	1253287·2	12·42	Highly Significant+
6. Interaction (M.T. × S. T) ...	8	2258077·4	282259·7	2·79	Significant+ +
7. Error (*b*) ...	50	5046462·2	100929·2	...	...
8. Total ...	89	33918172·0	...	...	...

+Significant at 1% level of probability
+ +Significant at 5% level of probability

TABLE XLIII.

Analysis of variance of fibre weights of *H. sabdariffa* var *altissima* (weight in grammes)

Variance due to	D.F.	S. S.	M. S.	F.	P.
1. Block ...	5	3689482·1	737896·4	...	...
2. Main treatments	4	2200843·5	550210·8	2·88	Significant+ +
3. Error (a) ...	20	3827539·4	191376·9	...	...
4. Main plot ...	29	9717865·0	...	...	...
5. Sub-treatments	2	240788·0	12394·4	4·23	Significant+ +
6. Interaction (M.T. × S. T.) ...	8	150444·1	18805·5	...	...
7. Error (b) ...	50	1424506·5	28490·1	...	...
8. Total ...	89	11533604·4	...	...	...

+ +Significant at 5% level of probability.

It may be seen from the analysis of variance of fibre yields that in *H. cannabinus* the difference due to both main-treatments (spacings) and sub-treatment (stages of harvest) are highly significant at 1% level of probability and the interaction between them is also significant but at a 5% level only.

In the case of *H. sabdariffa* var *altissima* on the other hand both the main and sub-treatments, though show statistically significant differences, they are but at a low level of probability (5%) and their interactional effect is not significant.

From Table XL and XLI it will be seen that in case of *H. cannabinus* the yield of fibre in both flower and pod stages is significantly better than at the bud stage, but between themselves they are at par.

Regarding the main treatments (spacing) the treatments $2'' \times 12''$ and broadcast have given significantly the highest yield but there is nothing to choose between them. Similarly the treatments no thinning $\times 12''$ and $4'' \times 12''$ form a group more or less identical and occupy a medium position from the point of significance. They are also significantly better than the treatment $6'' \times 12''$.

In the case of *H. sabdariffa* var *altissima* it will be seen that the yield of fibre at the pod stage is significantly better than that at flower stage or bud stage but between flower stage and bud stage the difference is not significant. Regarding the spacings broadcast is significantly better than all other treatments in the test. This corroborates the results obtained from the same test conducted in 1948-49.

The treatments $4'' \times 12''$, $2'' \times 12''$ and $6'' \times 12''$ form a medium group by themselves and are significantly better than the treatment no-thinning $\times 12''$ which has given the poorest yield. The interaction between the main and sub-treatments like previous year is not significant.

In the cultural experiment with *H. sabdariffa* var *altissima* the growth of the plant in general in all the units was below normal. This poor yield was due to incessant heavy rains during the growing period of the crop resulting often in long intermittent periods of water logging in the field which could not be properly corrected due to defective drainage system of the Farm and low situation of the experimental area. There was practically no intervening dry period available for doing the necessary intercultural operations for stimulating growth and the result was a stunted stand in the long run.

The fibres from both these experiments under different treatments have been sent to the Technological Research Laboratories for quality test and the results are awaited.

7. Other fibres

(*i*) *Sunn hemp*.—Six collections of sunn hemp obtained from Palamau, Kanpur, Gwalior, Chindwara and New Delhi were grown in the Kharif season. The growth was on the whole satisfactory till about bud stage when a serious outbreat of *Fusarium* practically destroyed the whole crop. With great difficulty only a small quantity of seed could be collected from apparently disease resistant plants for future study. The last two years' experience has shown that under Chinsurah Farm condition growing of sunn hemp in the Kharif season, either for fibre or seed is extremely risky due to the high rise of subsoil water level in the rainy season and subsequent fungus attack. The agrobotanical characteristics of these six collections were studied and recorded.

In winter four of these collections, namely, from Belgaon, Bulser, New Delhi and Gwalior were grown. The plants in each of them instead of growing to normal height as in the kharif season became dwarf and bushy. They were free from disease and produced copious seed pods loaded with seeds. This indicates that at least for conditions obtaining in places like Chinsurah Farm growing of Sunn hemp for seed purpose should be done in winter only as far as possible. For fibre,

however, it may be grown in the Kharif season only on very high lands free from water logging provided also that the soil is free from any pathogenic organism. It was also noted in winter-grown Sunn hemp that the first flush of flower is usually abortive but the later flushes which are very abundant, form quite healthy pods and seeds.

(*ii*) *Linseed*.—The comparative trial of two dual purpose Linseed types from U.P. was conducted for the third time during the year under review. The harvested crop has been dried and deseeded. The results will be reported upon in the next annual report. The results of the same test of the last year corroborate those of 1948-49; that is to say that regarding both the yield of seed and straw no significant difference between the two types under observation could be detected.

(*b*) A collection of twenty selected Flax × Linseed hybrid strains obtained from New Delhi and Sabour were grown for the study of their respective characteristics and multiplication of seeds for future observation. All these strains are supposed to possess the fibre yield and seed yield in a satisfactory combination to serve dual purpose.

For want of breaking and scutching appliances the yield and quality of fibre have not yet been ascertained. The straw materials have, however, been preserved for dealing with in future when opportunity is available.

(*iii*) *Ramie*—The old plantations at Chinsurah Farm have been maintained and an appreciably good quantity of seeds has been raised for supply to intending growers. A private party in Bihar has taken up Ramie cultivation on a big scale for which sufficient seed to cover five acres with necessary seedlings to start with, has been supplied from the Jute Agricultural Research Institute. A consignment of root-cutting (slips) sufficient to transplant one acre of land was also sent to the same party.

(*iv*) *Agave*—The nursery of Agave bulbils has been maintained. There has, however, been some casualties amongst the plants. Two distinct types of them based on the presence or absence of spines on the leaf margins have been recognised. The genuine *Agave sisalana* has a smooth margin with one hard spine on the tip of the leaf. The nursery now does not yet contain the necessary number of bulbils for setting up a fairly good sized plantation.

II. Anatomical and Cytological Studies.

The study of the distinguishing features of the fibre bundles and characteristics of the ultimate fibre cells with reference to the quality of the fibre in different fibre plants under observation has been in progress. The reaction of these different fibres to various stains for identification purpose, has also been recorded. With respect to *H. sabdariffa* var *altissima* and *H. cannabinus*, the two closely related species of *Hibiscus*, the existence of a direct relation between the number of ultimate fibre per fibre-strand and the quality ratio has been tentatively observed. In *H. cannabinus* the number of ultimate fibres per fibre-strand is significantly higher than those of *H. sabdariffa* with a quality ratio about 40% higher for the former. The higher tensile strength of the *cannabinus* fibre which is also implied in the quality ratio may therefore be due to the greater number of ultimate cells in its fibre-strand.

The experience gained from the anatomical observations has been found to be of great value in the identification of a large number of fibre samples received from various parts of India.

The determination of chromosome compliments of some fibre plants has been in progress.

III. Physiological Studies

Nutritional investigations in Mesta and Roselle—In order to study the effects of different sources of nitrogen at 20 lb available N per acre, two replicated trials were conducted with Mesta (*Hibiscus cannabinus*) and Roselle (*Hibiscus sabdariffa*

var *altissima*). The trial on Mesta failed due to heavy fungus infection.

The results in *Roselle* (*H. sabdariffa* var *altissima*) indicated that $(NH_4)_2\ SO_4$ gave a significant increase in height and base diameter over all other treatments. $NaNO_3$ and KNO_3 gave almost the same result. The increase in height and basal diameter was maintained throughout in $(NH_4)_2\ SO_4$. The fibre yield as a result of different manuring showed that $(NH_4)_2\ SO_4$ gave the best yield which is significant over all other treatments. The average yield of fibre per plant is given in Table XLIV.

TABLE XLIV.

The average yield of fibre in grams per plant.

H. sabdariffa var *altissima*.

Treatments	Average yield in gms.	% increase ever control	Remarks
$(NH_4)_2\ SO_4$ ...	100·7	162·2	Ammonium sulphate is significantly superior to the rest.
F. Y. M. ...	77·6	125·0	
Compost ...	76·7	123·5	
KNO_3 ...	74·0	119·2	
$NaNO_3$ ...	68·6	110·5	
Control (No manure)	62·1	100·0	
P ...	0·01		
S. E.% ...	1·9		
C. D. ...	0·54		

IV. Diseases

Hibiscus cannabinus—In connection with the development of the cultivation of Mesta (*H. cannabinus*) in Bengal, seeds were obtained from Uttar Pradesh. The seeds from Jhansi area produced a crop which remained stunted throughout.

The chief symptoms included arrest of apical growth with necrosis in the apical tissue. Consequently a bunchy top was produced. The leaves often remained crinkled and did not grow to normal size. From the reports received from several places and from observation in the experimental trials at Chinsurah farm, it is concluded that the disease was due to some seed-borne virus.

Crop raised from Jhansi seeds raised in 1951 showed similar symptoms, while crops from different seeds in the same field remained unaffected.

Downy mildew caused by *Plasmopara* sp. was found on Mesta immediately before the flowering stage. The attack was heavy, resulting in shedding of leaves. Wherever the apical bud was affected the plant subsequently was killed.

Hibiscus sabdariffa—Phoma sabdariffa appeared in an epidemic form. Leaf infection led to infection in stem and plants subsequently died. A good control of leaf infection was effected by Brordeaux mixture (4 : 4 : 40).

Crotalaria juncea.—Epidemic wilt occurred in several plots. *Fusarium* was obtained from the wilted specimens. The fungus is mainly soil-borne.

V. Pests

Incidences of *Phenacoccus hirsutus* on *H. sabdariffa* var *altissima* and *Tarache marmoralis* (Sida semi-looper) on *Sida rhombifolia* were considerable. *P. hirsutus* was, however, controlled by the application of 1% Nicotine sulphate spray. Detailed studies of the filamentous mouth parts, the mode and nature of injury by *P. hirsutus* were made. *Sida rhombifolia* and *Hibiscus cannabinus* have been recorded as alternate host plants besides those reported previously. The pest produces typical symptoms on these host plants as on *altissima*. The pest during late season attacks the capsules of *H. cannabinus* like *altissima*.

Effect of the incidence of Phenacoccus hirsutus at different stages of growth of altissima on fibre yield.—The trial failed due to water-logging.

Investigation on biological control of P. hirsutus.—Of the different parasites (Chalcidae) and predators (Coccinallinae) noted so far under Chinsurah condition, grub of one Coccinallinae beetle *viz. Scymnus (Pullus) pallidicollis* Muls. has been found to feed voraciously upon the eggs, nymphs and adult females and appear to be of use for biological control. *S. pallidicollis* has also been found to predate upon *Aphids* and *Pinnapis* sp. Further study on the predators is in progress.

The following pests have been recorded and identified from substitute fibre crops:

1. *Paroplapoderus gemmatus*, Thunb., (Curculionidæ; Coleoptera)-Leaf-roller of *Sida rhombifolia.*
2. *Tarache marmoralis*, F. (Noctuidae; Lepidoptera)—Sida semi-looper.
3. *Podagrica apicefulva*, Bry.-(Halticidae; Coleoptera)-Mesta and *altissima* stem-eating beetle.
4. *Oxycarenus hyalinipennis, Costa.* (Lygaeidae ; Hemiptera)-*altissima* pod-bug.
5. *Longitarsus belgoumensis*, Jac. (Halticidae; Coleoptera)—Sunn hemp leaf-eating beetle.
6. *Sylepta sp*—Urena leaf-roller.

MISCELLANEOUS

Enquiries—A large number of reports and comments on enquiries of various types relating to jute and substitute fibres were written and submitted during the year under report.

Exhibitions.—The Institute took part in some agricultural and industrial exhibitions organised by different organisations. Various types of jute and jute products and many other soft and hard fibres were exhibited. His Excellency the Governor of West Bengal visited our stall at the Industriai Exhibition organised by the Bengal Textile Institute at Serampore and took a keen interest in various kinds of fibres and fibre products exhibited.

Changes in the staff.—Sri A. K. Paul, Assistant Botanist, left this Institute and joined as Economic Botanist, West

Bengal Agricultural Department. Sri P. K. Mukherjee, Entomological Assistant, Sri S. Banerjee, Librarian and Sri S. K. Mukherjee, Junior Anatomical Assistant also left.

The following appointments were made during the period under report; Dr. K. V. Srinath, Cytogeneticist, Dr. M. K. Mukherjee, Assistant Chemist, Sri A. K. Sur, Librarian, Sri S. D. Mitra, Entomological Assistant, Sri S. B. Saha, Junior Anatomical Assistant, Sri P. Sanyal, Botanical Assistant and Sri A. Dutt, Agronomical Assistant, Substitute Fibre Section.

Visitors.—Among the visitors to the Institute during the year the names of the following may be mentioned: Professor Woon Young Chun and Dr. Hsioh-yu-Hon of the Institute of Systematic Botany, Academica Sinica, Peking, China, Dr. B. C. Guha, Member, Damodar Valley Corporation, Dr. P. V. Sukhatme, Indian Council of Agricultural Research, Dr. P. Parija, Pro-Vice-Chancellor, Benares Hindu University, Dr. B. S. Patel, Director of Agriculture, Bihar, Dr. H. K. Nandi, Director of Agriculture, West Bengal.

PUBLICATIONS

The following is a list of papers published or sent for publication during the year :

1. Dutt, R. M. and Paul, A. K. (1950)—Structure and development of the Female gametophyte in *Crotalaria intermedia*—Philippine Journal of Science.
2. Ghosh, T., Basak, M, and Kundu, B. C. (1951)—Effect of insolation and chemical treatment in relation to storing of jute seeds. Journal of Indian Phytopathology, New Delhi.
3. Basak, M. (1951)—Behaviour of jute seeds towards saline solution during the process of germination. Science and Culture.
4. Kundu, B. C. (1951)—Mesta, a substitute for jute Annual number of Business ueek, Madras.
5. Dutt, N.—On the forecasting of epidemic outbreak of major pests of jute. Proceedings of the Zoological Society of Bengal, Calcutta.

APPENDIX

Programme and Progress of Work

JUTE

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
I. BREEDING & GENETICS JUTE.		
(*i*) Collection of varieties & types including wild species of *Corchorus*.	In all 142 samples of local jute seeds including 132 samples of 1949-50 were grown. These included 80 *capsularis* and 62 *olitorius* samples. Performance of the crop in these plots was studied and primary selections of promising materials were made. 143 samples of jute seeds were received after the jute season presumably from the 1950 crop. This included 7 samples of seeds received from abroad, one each from Tokyo & Florida, 2 from Brazil and 3 from China. *Wild species of Corchorus*—15 samples of seeds 13 from Bombay & 2 from Saurashtra	Collection of indigenous and exotic races of jute will be continued for study & isolation of promising strains. Collection of wild species of *corchorus* will be continued and those in our collection maintained as a stock of breeding materials.

	were received & grown along with the materials already in our collection. All these materials were studied and classified. There are at present 8 wild species of *Corchorus* in our collection.	
(*ii*) Breeding of improved strains of jute.	10 breeding trials were planned and sown with 370 cultures brought forward from the previous year's crop.	To be continued.
	65 primary & 3330 secondary selections were made in the type plots and the breeding trials respectively for further study.	
	Varietal trials—4 varietal trials, 3 *capsularis* and 1 *olitorius* were carried out with some of the strains evolved by Jute Agricultural Research Institute. 2 of the *capsularis* trials failed due to adverse weather condition. Yield data of the successful *capsularis* & *olitorius* trials were analysed.	To be repeated.
	C39-212, a *capsularis* strain, yielded 6% higher and matured 2 weeks earlier than the control and also gave a quality ratio of 110 as against 93 of D154 (control).	

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
	O40-632 and O40-753, two *olitorius* strains gave a higher yield of 33 & 27% respectively than C.G. (control). Another *olitorius* strain, O39-620, yielded 11% higher than the control and gave an excellent quality ratio of 133 as against 109 of C.G.; O40-753 followed closely with a ratio of 104.	
Polyploidy & interespecific hybridization in jute.	11 *capsularis* plants obtained from 1948 treated materials maintained morphological features of the parents.	Polyploid races of *C. capsularis* & *C. olitorius* to be fixed and inter-specific crosses to be attempted between polyploids of the two species.
	In 1950, 1250 seeds each of *C. capsularis* and *C. olitorius* were treated in 25 treatments combining 5 concentrations of colchicine and 5 different periods of soaking. 27 plants of *capsularis* and 21 of *olitorius* were found to exhibit polyploid appearance. Materials were fixed for cytological studies.	
Vegetative rapprochement as a means of overcoming interspecific cross incompasibility.	Seeds from progenies of 1949 grafts and from 20 fresh grafts made in 1950 were carried forward.	Interspecific crosses between grafts of the two species will be attempted.

(*iii*) Inheritance of characters.		
Genetic strains.	All the 45 strains were grown along with 10 cultures brought forward from the purification series & studied.	True breeding strains will be maintained & isolation of new strains will be continued.
	A total of 390 selections were carried forward from various sources.	
Isolation of genotypes.	The behaviour of 3 full-green non-branching genotypes in respect of the reducer gene and the multiple allelomorphs affecting the distribution and intensity of the pigment was confirmed.	To be continued.
	A large number of test crosses were made for isolation of other full-green genotypes.	
Anthocyanin pigmentation.	F_1s of the crosses between the deep-red type and other pigmentation grades were studied and backcrosses made. Materials were carried forward for further study.	Study of F_2 and backcross families.
	110 fresh crosses were obtained to study the mode of inheritance of pigmentation in foreign types and their behaviour when crossed with Indian types.	Study of F_1, F_2 and backcross families. Backcrosses to be made.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
	F_1s of the crosses made in 1949 were studied & materials were carried forward for further studies.	
Extra axillary branching.	The F_1s were all branched and the branches had axillary buds. Backcrosses were made.	Study of F_2 and backcross families.
Repand (wavy) leaf in *capsularis*.	The shape of the margin of the leaves of F_1s were intermediate between those of the parental types. Back-crosses were made.	—Do—
Leaf variant.	The F_1s of crosses between normal and variant were all normal looking plants. They were backcrossed to both the parents.	—Do—
Serrated petal in *olitorius*.	Petal character of more than 4000 plants in 4 F_2 families was studied and the plants were classified. The petal character showed all degrees of serration from fully normal to the fully clawed shape.	Study of some of the materials at the F_3 stage.
Chlorosis in jute.	38 *capsularis* & 4 *olitorius* chlorotic plants were selected and the patterns of chlorosis were described. Crosses between chlorotic	Study of the progenies of chlorotic plants and the F_1s of crosses made.

	plants and also between chlorotic & healthy plants were obtained.	
(*iv*) Subvention Trials of improved strains.	70 subvention trials, 30 in West Bengal, 14 in Assam, 10 in Orissa and 16 in Bihar were planned. Seeds and necessary papers were sent to the staff concerned in proper time. 23 trials in all were reported to have failed for various reasons. Of the remaining 47 trials, final reports on 31 trials have so far been received. Final reports on 16 trials, 3 of Assam & 13 of Bihar are yet to be received.	To be continued.
	Technological tests of the samples of fibres sent from subvention trials are in progress.	
II. Anatomical Studies.		
(*i*) Developmental anatomy of axillary buds in the branching & in non-branching types of jute.	Developmental anatomy of the axillary buds in the branching and in some non-branching types of *C. capsularis* was studied.	To be continued with reference to other species of *Corchorus*.
((*ii*) Structure & quality of fibre in jute & its substitutes.	It was observed that the quality ratio increased with the increase in the number of ultimate fibre cells per fibre strand. The higher quality ratio of *C. olitorius* and	To be continued in greater detail.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
	H. cannabinus as compared to *C. capsularis* and *H. sabdariffa* var. *altissima* respectively would thus appear to be due to the higher number of ultimate fibre cells per fibre strand in the two former speeches.	
(*iii*) The effect of maturity on the length, breadth & lumen of ultimate fibre cells.	The breadth, lumen & length of the ultimate fibre cells were studied in six stages of maturity of Fanduk, a *capsularis* variety reputed for its fibre quality. The breadth & lumen of the ultimate cells attain their maximum dimensions at the bud stage. It is borne out by technological tests that harvest at this stage always yield good quality fibre. At the later stages the fibre cells shrink along their longer axes.	To be continued (if necessary.)
(*iv*) Routine identification of fibre samples.	Samples of fibre were received from a good number of sources for identification & for opinion regarding their suitability as a substitute. The required informations were furnished after examining the fibres.	As in column I.

III. CYTOGENETICAL INVESTIGATIONS.		Study of the secondary system in different varieties of *C. capsularis* in relation to fibre development.
(*i*) Study of chromosomes.	Chromosome survey of the indigenous & exotic species of Corchorus has been in progress. *C. siliquosus* was found to have 14 haploid chromosomes.	(*i*) To be continued with particular reference to variations in morphology of the Karyotypes.
(*ii*) Cytology of the colchicine treated plants.	Preliminary examination of the pollen mother cells indicated increase in number of chromosomes.	(*ii*) To be continued along with induction of polyploidy with other carcinogens.
		(*iii*) Cytological analysis of intervarietal crosses.
		(*iv*) Study of factors involved in stray incompatibility between *C. capsularis* & *C. olitorius in crosses.*
IV. PHYSIOLOGICAL STUDIES		
(*i*) Investigations on the physiology of jute seeds		
(*a*) Natural occurrence of percentage viability of jute seeds in different pods.	It was found that on average 71.3% of *capsularis* and 75.0% of *olitorius* seeds per pod remained viable. Though the number of	Further work will be continued on different position of the pods on the plant, their age and rela-

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
	seeds per pod varies considerably in *capsularis* & *olitorius* (36.6 & 127.0) the percentage of non-viable seeds was more or less the same. Therefore number of viable seeds per pod, available in *olitorius* was more than in *capsularis*.	tion to the viability of seeds.
(*b*) Effect of storage on viability of jute seeds.	The seeds of 6 *capsularis* varieties & 5 *olitorius* varieties of 1948-49 & 1949-50 were tested. *Capsularis* and *olitorius* seeds behaved differently in their % germination and radicle growth which also differed according to the years of storage. *Olitorius* showed marked difference in the rate of radicle growth much slower than the *capsularis* under the same conditions of temperature & moisture.	To be continued in relation to temperature & storage period—chemical nature may be tested.
(*c*) Dormancy in jute seeds.	Seeds of freshly harvested pods of different varieties of *capsularis* (D154) showed a higher rate of germination percentage than *olitorius* (C.G.) under different temperatures.	To be continued with seeds collected at different stages of maturity.
(*d*) Salt toleration in jute seeds at the time of germination.	The seeds in both *olitorius* and *capsularis* could not tolerate a concentration higher than 1.0% Nacl and even at this concentra-	To be continued & further extended with post-germination phases.

	tion, the germination was delayed. The delaying effect was more marked in case of older seeds of 1948-49 than in seeds of 1949-50. *Capsularis* seeds are more tolerant to the concentrations used than seeds of *olitorius*.	
(*ii*) Root system in different jute species.	Growth & distribution of roots in different kinds of soils was studied. The length of tap-roots differ in different soils, as well as in different species. The secondary roots were more elongated and penetrated to greater depths in *olitorius* than in *capsularis*. In *capsularis* the root-branches were more superficial and bushy in nature than *olitorius*.	To be continued in relation to different growth phases.
(*iii*) Physiology of growth in different species & varieties of jute with reference to moisture content, bark formation & wood development during the life cycle of the plant.		
(a) Variations in dry weight.	The amount of dry material in the bottom regions was always more than the apical portions. Addition of dry matter gradually increased with the growth of the main	The experiments would be repeated in greater detail.

Programme of work as sanctioned.	Progress of work in 1950-51	Future programme of work in 1951-52.
	stem in height towards the apical regions. The maximum dry matter was found in all the regions in the advanced stage of 121 days growth. Comparison of the total dry weight at different stages, showed that the rate of additions of dry matter was quicker in *olitorius* than in *capsularis*.	
(*b*) Variations in moisture content.	The moisture content in the stem varied from top to bottom showing a close relation with apical growth. The water economy changes from vegetative phase. to the reproductive phase and then to the ripening phase. The sequence of changes was similar in both *capsularis* and *olitorius* with specific differences.	The experiments would be repeated.
(*c*) Comparative variations in the formation of bark and wood	The important results found were—(*i*) that the weight of the bark exceeded from that of wood in the vegetative stage, bud stage and flowering stage. (*ii*) In pod stage the weight of wood exceeded that of bark. (*iii*) More fibre was laid in the upper regions of the stem during the flowering stage. (*iv*) Both D 154 and C. G. behaved similarly, in general, with specific differences. (*v*) Throughout the changes in bark growth and	To be continued.

	wood formation a definite ratio was maintained which in the present studies varied from 0.6 to 1.2 in C.G. and 0.7 to 1.3 in D 154 which is almost the same in both the species. (*vi*) Fibre ratio was maximum in both the species in the period from bud stage to flowering stage.	
V. JUTE AGRONOMY		
(1) Possibilities of growing jute in lines.	The treatments included specings of 2″ × 12″, 3″ × 12″, 4″ × 12″, light thinning × 12″ against usual broadcast sowing. The broadcast plot was wedded as usual three times. Line plots received 1st weeding by hand and subsequent intercultural operations were only wheel-hoeing three times.	To be continued. Other spacing treatments to include various plant populations under manured and unmanured conditions, will be included.
	The cost of production in the line plots were lowered by about 15% in the *capsularis* and 15% in the *olitorius* and profits were much higher than broadcast plots.	
(2) Manurial trials with jute.	The treatments included were 20 lbs. and 40 lbs of nitrogen, 25 lbs and 50 lbs of K_2O and various combinations of N & K, Compost, Sludge, FYM and no manure (control).	The trials will be modified to include treatments of N, P & K at 3 levels and their combinations.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
(*i*) To study the effect on yield & quality of fibre of varying doses of nitrogen & potash & their combinations.	*In capsularis*: Response to nitrogen was positive; N_2K_1 gave the highest yield closely followed by N_2, N_1K_2 & C_2; N gave much higher yield than K. Combination of N & K gave best results & of the organic series of N, Compost proved to be the best. *In olitorius*:—N & K increased yield when used alone or in combinations. N_2K_1, N_2K_2, Compost gave much higher yield.	
(*ii*) Application of fertilisers in instalment.	The treatments included application of 30 lbs of N in one, two and three instalments. No significant differences between treatments was noticeable in *capsularis* though instalment application gave better yield, while in *olitorius* instalment application gave significantly better yields.	To be continued.
(*iii*) To study the comparative merits of inorganic nitrogenous fertilizers at 30 & 60 lbs of nitrogen per acre.	The treatments included 30 & 60 lbs nitrogen per acre from ammonium sulphate, sodium nitrate, potassium nitrate and ammonium nitrate. 60 lbs of nitrogen from all the sources proved better than 30 lbs of nitrogen. There was no significant	To be continued. Sources of other nitrogenous fertilisers to be included.

	difference between various sources of inorganic nitrogen fertilisers.		
		(*iv*) Studies on effects on yield of combinations of organic & inorganic sources of nitrogen with *capsularis* & *olitorius* jute will be included.	
		(*v*) Effect on yield at different levels of nitrogen per acre.	
		(*vi*) To study the effect on yield of fibre of varying doses of nitrogen & lime in carying soils & climatic conditions.	
		Simple trials (with *capsularis* & *olitorius* jute) in cultivator's plots in various jute growing states in 1951-52 will be conducted. Soil, analyses before and after jute, under various manurial treatments will be included.	

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
(3) Intercultural experiments. To study the effects on yield & quality of different frequency & time of intercultural operations.	Abnormal continuous heavy rains specially at the earliest stages interfered very much with proper intercultural operations this year. This resulted in very much stunted growth and the experiments had to be abandoned.	
(4) Triple-cropping & double-cropping of jute land. (*i*) Triple-cropping (*capsularis* jute, paddy & pulses (gram & khesari). (*ii*) Triple-cropping (*olitorius* jute, paddy & pulses (gram & khesari).	The yields of fibre in jute obtained was more from later stages of harvest. Maximum paddy yield was obtained from plots where paddy could be transplanted earlier (*i.e.* plots released from pre-bud stages harvest of jute). When the value of both the produce (jute & paddy) was considered, maximum return from the produce was obtained from flower stage harvest of plots of the first crop (jute). Higher yields were obtained from late paddy than early paddy. The yield of gram in case of *capsularis* jute was also higher from harvest of jute at earlier stages whereas with *olitorius* the higher yield of khesari was obtained from harvest of jute at later stages. When the combined value of jute, paddy & gram or	To be continued under manured & unmanured conditions. Soil exhaustion studies under various treatments will be included.

	khesari was considered maximum return from produce in terms of money was obtained from flower stage harvest of 1st crop (jute).	
(*iii*) Double-cropping in low land (jute followed by paddy).	Late jute has done better than early jute. Maximum paddy yield was obtained from plots where paddy was transplanted. Highest return was obtained from combined crops of jute and paddy with bud-stage harvest of jute.	
		(*iv*) Mixed cropping with jute.
		(*a*) seed rate in mixed cropping.
		(*b*) effects on yield & quality of mixed cropping.
		(*v*) Collection of detailed information & data on jute cultivation practices & position of jute in the local cropping system in the various jute growing localities.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
(5) Effect of date of sowing on plant growth, flowering yield, disease & pest.	From the results obtained it may be concluded that the sowing period can be extended with early variety *capsularis* jute, whereas this period is very limited with *capsularis* late variety (D 154) or in other words March is the best time for late variety jute (D 154) but early (Fanduk) can be sown profitably from 15th February to 1st week of May. In *olitorius* earlier sowing in April had to be irrigated without which neither germination nor proper crop growth was possible.	The experiments will be continued.
VI. Soil & Microbiological Studies.		
(*i*) Biochemical studies of retted jute, retting water and soil.		
(A) Action of different activators on the retting of jute.	Jute stems together with difinite proportions of Ammonium sulphate, Bone dust, Tribasic potassium phosphate, Ammonia-water, pottassium nitrate and straw (when soaked in 0.5% solution and when retted, retted in a solution of 0.1% strength with	Studies to find out the exact proportions of N, P & K under optimum conditions will be made. Study of natural substances will be continued.

	respect to the retting water) were retted in the laboratory. All these have been found to reduce the retting period. Reduction has been upto 34% of control. Bone dust has been found to be the best (usually 34-38% of control). Periodic determinations of pH; Ca, P(both inorganic & organic) were made.	
(B) Isolation & characterisation of specific strains of bacteria and fungi responsible for retting of jute & substitute fibres.	Attempts for isolation of retting bacteria were continued.	To be continued. Properties of isolated organisms to be studied.
(*ii*) Analysis of soils & manures for their chemical & mechanical constituents.	(*a*) Routine analyses & identification of manures and fertilisers were done.	To be continued. (*b*) Analysis of soil samples from different jute growing areas with a view to *Soil Survey* will be done.
(*iii*) Soil exhaustion studies. (*a*) To investigate the amount of exhaustion of soil in double and triple cropping lands.	The soils were obtained before jute & after jute, paddy & pulse from the double & triple experiment of the Agronomy Section. Periodic determination of available P, exchangeable Ca and K, total N & organic matter from double cropping plots before and after jute and after paddy were done. Samples after pulses have been	To be continued for the next crop.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
	received too late to be analysed. Results so far obtained indicated that soil was not appreciably exhausted.	
(*b*) To study the amount of exhaustion in manurial trials with jute.	Soil samples before jute and after jute were obtained from the manurial trial plots of the Agronomy Section. Periodic determination of available P & exchangeable Ca and K, total N, organic matter as also P fraction of soils from *capsularis* manurial trial plots before and after jute was done.	To be continued.
(*c*) Withdrawal by the plant of N,P,K.	Plant materials were obtained from manurial trial plots. Withdrawal by the plant of P & K was studied from samples obtained from different experiments.	To be continued.
(*iv*) Development of methods & determination of nutrients for advisory work in connection with manuring, etc.	Some progress was made but no definite results obtained.	To be continued.

(*v*) Role of plant nutrients and soil conditions regarding susceptibility to disease.	Soils from areas affected, were analysed for exchangeable Ca, available P, exchangeable K & organic matter and the pH was determined.	To be continued.
		(*vi*) Attempts will be made to find out maximum production capacity of jute under the influence of nitrogen.
VII. DISEASE.		
1. Study of the effect of environmental factors on secondary leaf infection due to *Macrophomina phaseoli*.	High humidity (95% & above) & high temperature 85°F & above are very congenial for the spread of leaf infection. Maximum pycnospore liberation takes place on a rainy day. Earlier sown crops were better adapted to resist infection.	To be concluded in 1951-52.
2. Study of the stem-rot fungus.	Application of ammonium sulphate in the Chinsurah farm soil followed by inoculation with Sclerotia bearing stubbles can initiate infection under laboratory conditions.	Investigations to find out factors limiting pathogenicity will be carried out.
(*i*) Inoculation experiments.		
(*ii*) Study of cultural characteristics.	Absence of nitrate in synthetic medium retards growth of mycetium. The hyphae become slender and sclerotia production is delayed.	To be continued.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
(3. Study of the biology of pathogens other than *Macrophomina phaseoli*.	(*i*) *Chlorosis*:—Seedborne nature of chlorosis has been established.	(*i*) Experiments to elucidate the nature & manner of transmission of chlorosis through seed will be made. (*ii*) Study of the incidence of soft-rot in different varieties will be made. (*iii*) Viability of the sclerotia of *Sclerotium rolfsi* will be studied.
4. Investigation on the methods of control of stem-rot, root-rot and other diseases.		
(*i*) Selection & breeding of stem-rot resistant types.	112 selections have been brought forward. Infections in general were very low.	Selections to be made and brought forward for further trial.
(*ii*) Application of fertilisers to check incidence of disease.	No incidence of diseases in manurial trials were observed.	Observation will be taken in manurial trials to be conducted at Chinsurah and other places.

(*iii*) Seed treatment and storage.	A trial was conducted to find out the (*i*) effect of age on yield, (*ii*) advantage of treatment of seed in retaining viability. It is found that viability depends not so much on age as on condition of storage.	A comparative yield trial will be continued with seeds stored for different lengths of time with different viability rates.
(*iv*)' Chemical sprays to control leaf infection.	Perenox 1% was found 100% effective against leaf infection of *Macrophomina phaseoli*.	Regular trial will be conducted if field conditions permit. Usual records and observation will be kept on all spraying operations.
VIII. PEST		
Study on *Apion corchori*.	Susceptible region of stem for *Apion* oviposition has been determined on the basis of observations made on 4719 ovipositions on 2000 affectel plants.	Study on the anatomical and physiological variations, if any, between the susceptible and non-susceptible region of stem to Apion damage.
	Analysis of data from 1st year's varietal trial indicates that C42-KJ-321 is more resistant to *Apion* damage than other fixed *capsularis* types.	To be continued.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
	No significant varietal difference has been observed between fixed *olitorius* types against *Apion* in *olitorius* varietal trial.	To be continued.
	Last year's selections of *olitorius* & *capsularis* types for Apion resistance were brought forward. Some of the selections specially one from C42-Kj-321 are promising.	To be continued.
	Apion corchori has been found to cause more damage to crops raised during the month of April to 1st week of May.	To be continued.
Study on *Laphygma exigua.*	*Laphygma exigua* causes more damage to crop sown till the middle of April.	To be continued.
Study on *Anomis sabulifera.*	Crop sown late becomes more liable to damage by *Anomis sabulifera.*	To be continued.
Study of *Hemitarsonemus latus.*	Liability of crop to damage by *H. latus* increases when sown early.	To be continued.
Nupserha bicolor ssp. *postbrunea.*	New record from *olitorius* jute. Indications are that the pest may turn to be one of the major pests for *olitorius* types. Study on the biology of the pest continues.	To be continued.

	Stem with diameter 0.2 cm to 0.4 sm has been found to be susceptible for damage.	Further corroboration.
		Correlation study between the mandibular length of the pest and the susceptible stem-diameter.
Effect of damage by different major pets on yield of jute.	Trial failed because of water-logging.	To be continued.
I. Botanical & Agronomical Studies.	SUBSTITUTE FIBRES.	
1. Collection of varieties and types.	Collection of seeds of different fibre plants from different parts of India & from abroad, was continued and some additions were made to the original stock.	To be continued and further additions will be made.
2. Study of the characteristics of different fibre plants.	The distinguishing features in the growth and developmental characteristics of the different fibre plants under observation were recorded and verified with the previous year's observation.	To be continued.
3. Isolation of types.	Selections for various characters in *H. cannabinus* and *H. sabdariffa* were grown for purification and detailed observation. Further selections were made.	The study of the future behaviour of these selections will continue.

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
4. Hybridization.	(*i*) The inheritance of pigmentation pattern in some suspected natural hybrids of *H. sabdariffa* var. *altissima* was studied and different distinguishing phenotypes were identified. Some new and back crosses between the individuals of the different phenotypic groups and the parents have been made. A number of fresh crosses were made amongst different anthocyanin pigmentation grades, bristled and non-bristled characters and varying leaf shapes in *H. sabdariffa*. A number of fresh crosses were also made amongst the six different pigmentation grades of *H. cannabinus*.	This work will be continued.
5. Date of sowing experiment.	Trials with *H. sabdariffa* var. *altissima* and *H. cannabinus* were sown at intervals of 15 days. The work has been in progress.	To be continued.
6. Trial of spacing and stage of harvest of *H. cannabinus* and *H. sabdariffa* var. *altissima*.	Regarding the main treatments (Spacing) in case of *H. cannabinus*, the treatments (2″ × 12″) and 'broadcast' have given significantly the highest yield but there is nothing to choose between them. Similarly the	This will be continued for 3 years more.

treatments (no thinning × 12″) & (4″ × 12″) form a group more or less identical and occupy the medium position from the point of significance. They are also significantly better than the treatment (6″ × 12″). Interaction between main treatments and sub-treatments is significacnt at 5% level.

In case of *H. sabdariffia* var. *altissima* broadcast is significantly better than all other treatments in the test. This corroborates the results obtained from the same test conducted in 1948-49. The treatments (4″ × 12″), (2″ × 12″) and (6″ × 12″) form a medium group by themselves and are all significantly better than the treatment (no thinning × 12″) which has given the poorest yield. The interaction between the main and the sub-treatments, like previous year, is not significant.

Regarding sub-treatments (stage of harvest) in case of *H. cannabinus* (Mesta) the results show that the yield of fibre in both flower and pod stages is significantly better than at bud stage but between themselves the difference is not significant. In the case of *H. sabdariffa* on the other hand, yield of fibre at the pod stage is signifi-

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
	cantly better than at flower stage while the latter is not better than the bud stage. Fibre from both these experiments under different treatments have been sent to T.R.L. for quality test and the results are awaited.	
7. *Varietal trials.*	Not done for want of sufficient seeds.	(*i*) Trials of 36 promising primary selections of *H. canabinus* will be conducted to study their respective yield performance and for further selection. (*ii*) A varietal trial of six varieties of *H. cannabinus* obtained from Hyderabad will be conducted. (*iii*) A varietal trial of 5 varieties of *H. sabdariffa* obtained from different sources will be conducted. (*iv*) A seed rate experiment on *H. sabdariffa* var. *altis-*

		sima will be conducted to determine the optimum seed rate.
8. Special fibres. (*i*) *Sunn hemp.* The study of the growth characteristics of collections under Chinsurah condition.	Six collections of sunn hemp obtained from Palamau, Kanpore, Gwalior, Chindwara and New Delhi were grown in the khariff season but the crop was badly attacked with Fusarium disease like last year. The growth was on the whole satisfactory till about bud stage when a serious outbreak of Fusarium practically destroyed the crop. With great difficulty only a small quantity of seed could be collected for future study. Two years experience has shown that under Chinsurah conditions growing of sunn hemp for fibre in the khariff season is extremely risky due to the high rise of the subsoil water-level and subsequent fungus attack.	(*a*) Study of the agro-botanical characteristics of the collections will be continued. (*b*) Selection of *Sunn* hemp plants resistant to wilt (Fusarium) will be made. (*c*) Yield trial of sunn hamp collections received from different parts of India will be undertaken.
(*ii*) *Linseed* Trial of dual purpose linseed types.	A trial of two dual purpose types obtained from U.P. was conducted in the winter season. The results will be reported upon in the next annual report. The results of the same test of the last year corroborate those of that of 1948-49, that is to say, that regarding both the yield of seed and straw no significant difference between the two types under observation would be detected.	A trial of 20 selected strains obtained from different parts of India will be undertaken to study their possibilities as dual purpose crop under Bengal conditions.

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(*iii*) *Ramie*.	The plantation at Chinsurah has been maintained. An appreciably good quantity of seeds has been raised and supplied to intending growers.	(*a*) The plantation will be maintained. (*b*) Attempts to evolve an efficient and easy method of degumming of Ramie fibres by chemico-biological means will be made.
(*iv*) *Agave*.	The nursery of agave bulbils has been maintained. The nursery now does not yet contain the necessary number of bulbils for setting up a fairly good sized plantation. Moreover the seedlings do not all represent the progeny of genuine agave *sisalana*.	(*a*) More bulbils of *Agave* belonging to the different species such as *Agave sisalana*, *A. cantala* etc. will be obtained from different parts of India and outside. (*b*) The available bulbils in the nursery will be planted.
9. Seed multiplication.	Seeds of different fibre plants under observation were multiplied on a varying but moderate scale at the Chinsurah farm for distribution.	To be continued..

II. Anatomical & Cytological Studies.	(*i*) Study of the distinguishing features of the fibre and the characteristics of the ultimate fibre cells and the study of the reaction of the different fibres to various stains are in progress.	The study of the anatomical and cytological peculiarities of the different fibre plants under observation will be continued.
	(*ii*) The determination of chromosome complements of some fibre plants has been done.	Effect of colchicine in inducing polyploidy in *H. cannabinus* and *H. sabdariffa* and a few other fibre crops will be under study.
III. Physiological Studies.		
(*i*) Nutritional investigations—manurial trials on Mesta (*Hibiscus cannabinus*) and Roselle (*H. sabdariffa* var. *altissima*).	Mesta failed due to heavy infection. Roselle trials showed the following percentage increase in fibre yield by different fertilizers and manures, over control (no manure):—$(NH_4)_2SO_4$—164.8%, F. Y. M.—125.7%, Compost—125.6%, KNO_3—120.4%, $NaNO_3$—111.2%	(*ii*) Study of the growth & developmental phases of Mesta and Roselle under normal conditions.
		(*iii*) Study of the effect of trace elements on the growth and development of Mesta & Roselle.
		(*iv*) Study of the photoperiodic effect and vernalisation

Programme of work as sanctioned.	Progress of work in 1950-51.	Future programme of work in 1951-52.
		in reducing the vegetative period of Roselle.
IV. DISEASE.	Incidence of *Phoma sabdariffa* and *Cercospora hibiscii* on *H. subdariffa* var. *altissima*, *Uromyces* spp. and *Fusarium* on *Crotolaria juncea* & *Fusarium* on *Urena lobata* have been recorded. The study on the biology of these fungi has been undertaken by the Mycology Section.	Further studies on fungus disease attacking the different fibre crops will be continued.
V. PESTS.	Further studies on the biology of *Phenococcus hirsutus* have been again continued. Regarding control measures again a 1.5% Nicotine sulphate solution has been found to be effective against this pest.	Investigation on the biology & control of insect pests of fibre crops other than jute will be continued.

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